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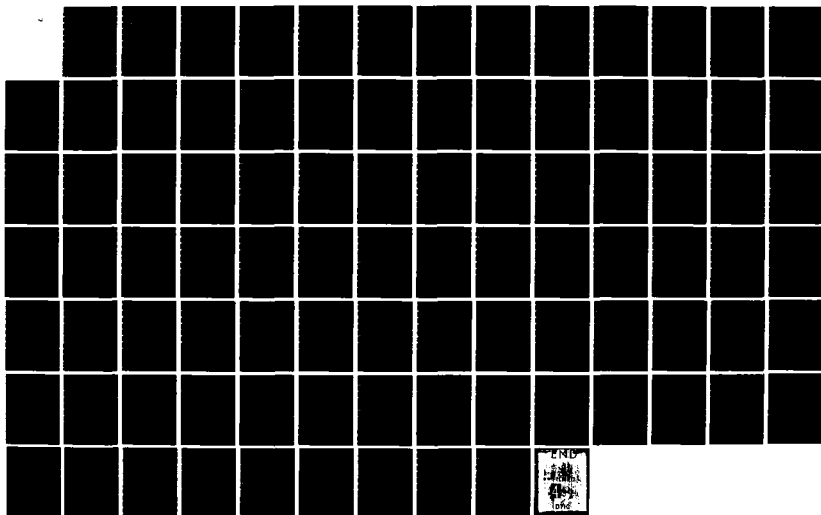
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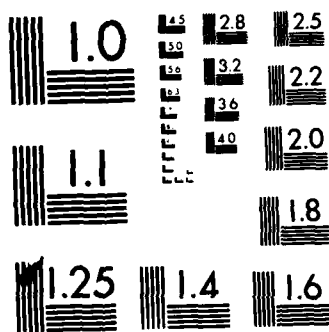
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EVALUATION OF THE  
TRI-SERVICE PATIENT APPOINTMENT AND SCHEDULING SYSTEM  
AT USAF MEDICAL CENTER, KEESLER AIR FORCE BASE

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Final Report for Period 2/16/82 to 2/15/84

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Prepared for

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 Arthur D. Little, Inc.

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## SUMMARY OF FINDINGS

In February 1983, an automated Tri-Service Patient Appointment and Scheduling (TRIPAS) System (initial capability) was installed at USAF Medical Center, Keesler Air Force Base (Keesler), Biloxi, Mississippi. Keesler is the fourth site to receive TRIPAS under a contract from the Tri-Service Medical Information Systems (TRIMIS) Program Office (TPO).

This report contains information on an evaluation of the automated TRIPAS System at Keesler. Conclusions are based on a comparison of patient appointment and scheduling operations using an automated system with pre-automation (baseline) functions, taking into account system goals and objectives and user criteria for patient appointment and scheduling services. Conclusions drawn about the functionality and benefits of TRIPAS, at Keesler and elsewhere, will be used to plan for future use of automated appointment and scheduling systems within DoD.

The evaluation was designed to study important attributes and features of the appointment and scheduling operations that might be affected by the TRIPAS System, including:

- Availability of appointments;
- Time required to make, change, verify, or cancel an appointment;
- Waiting times within clinics, and in the time period from initial entry into the medical care system to diagnosis and treatment in the appropriate clinic;
- Availability of medical records and X-rays at the time of an outpatient visit;
- The number of patients who miss their appointment;
- Patient and staff satisfaction with the appointment and scheduling system;
- Optimization of patient/care provider encounters;
- Effort required to make or change provider schedules; and

- Cost per appointment transaction and per outpatient visit.

Data that quantified these features were collected and then compared for the baseline and post-implementation evaluations.

Data were collected for the baseline study from October 4 to November 1, 1982. After collection of baseline data was completed, installation of the TRIPAS System was closely observed. The system's readiness for post-implementation evaluation was documented in an interim Implementation Monitoring report (2). Post-implementation data were collected from May 16-27, 1983. In addition, provider productivity data were collected the year following the baseline study for all of October, 1983.

Like the baseline study, the post-implementation evaluation at Keesler includes information gathered from the Central Appointment Section (CAS), the Medical Records Department, and a sample of representative outpatient clinics. Five clinics were included in the study: Primary Care, Internal Medicine, General Surgery, and Orthopedics, plus the Dental Clinic for which only qualitative data were collected. These clinics were selected on the basis of their scheduling methods and the volume of patients seen, especially active-duty personnel. Two of the clinics in this sample (Internal Medicine, Primary Care) used CAS for making patients' appointments; the others booked appointments using their own appointment and scheduling clerks.

#### Results

Table S-1 compares the results of the baseline evaluation to the results of the post-implementation evaluation. The table and the subsequent discussion are organized to correspond to the process a patient goes through in receiving routine outpatient care: requesting an appointment; being scheduled for an appointment; having a medical record located and sent to the appropriate clinic; and being seen by a care provider at the appointed time. Keesler staff were initially asked their perception of minimum, average and maximum expected goals for some areas that might be improved by the TRIPAS System. Table S-2 outlines these goals.

**SUMMARY OF BASELINE AND POST-IMPLEMENTATION  
EVALUATION RESULTS, TRIPAS EVALUATION AT  
USAF MEDICAL CENTER, KEESLER AIR FORCE BASE**

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TABLE S-1 (continued)

<u>Impact Area</u>	<u>Evaluation</u>		<u>Change</u>
	<u>Base</u>	<u>Post</u>	
<u>Scheduling an Appointment (continued)</u>			
Percentage of respondents indicating that patient appointment and scheduling system is important <sup>a</sup> to the quality of care at the facility:			
Providers	92	96	+4 percentage points
Support staff	93	94	+1 percentage points
Percentage of respondents satisfied <sup>a</sup> with overall quality of appointment and scheduling service or with appointment system in general:			
Patients	65	72	+7 percentage points
Providers <sup>b</sup>	49	63	+14 percentage points
Support staff <sup>b</sup>	75	88	+13 percentage points
Percentage of respondents with same day multiple clinic appointments	6.3	9.2	+2.9 percentage points
<u>Locating Medical Records</u>			
Percentage of scheduled patients who have a medical record available at time of appointment <sup>b</sup>	85	87	+2 percentage points
Percentage of respondents satisfied <sup>a</sup> with availability of medical records:			
Patients	86	87	+1 percentage points
Providers	69	72	+3 percentage points
<u>Receiving Care at the Appointed Time</u>			
Percentage of patients having care provider contact within 15 minutes of their appointment	40	44	+4 percentage points
Average waiting time (min) for scheduled patients	29	26	-3 min



TABLE S-1 (continued)

<u>Impact Area</u>	<u>Evaluation</u>		<u>Change</u>
	<u>Base</u>	<u>Post</u>	
<u>Receiving Care at the Appointed Time</u> (continued)			
Percentage of respondents satisfied <sup>a</sup> with waiting times in the clinic:			
Patients	63	64	+1 percentage points
Providers	72	80	+8 percentage points
Percentage of "no-show" patients in all four clinics			
	6.0	5.8	-0.2 percentage points
Number of patients seen per provider hour (sample of 8 providers)			
	3.04	3.27	+0.23 percentage points
Number of patients seen per provider hour--all providers			
	1.84	2.15	+0.31 percentage points
Cost (cents) per transaction in CAS			
	43	74	+31¢

<sup>a</sup>Levels of satisfaction and importance are defined as including "very" and "somewhat" positive responses to a question.

<sup>b</sup>See Table S-2 for performance goals established for this area.

KEY: Base = baseline (manual system) study.

Post = post-implementation (automated system) study.

TABLE S-2

PERFORMANCE GOALS ESTABLISHED FOR DESIGNATED IMPACT AREAS,  
TRIPAS EVALUATION, USAF MEDICAL CENTER, KEESLER AFB

<u>Impact Area</u>	<u>Performance Goals</u>		
	<u>Minimum</u>	<u>Average</u>	<u>Maximum</u>
Time required to book an appointment in CAS	144 sec*	240 sec	420 sec
Percentage of respondents satisfied with overall quality of appointment and scheduling service or with appointment system in general:			
Providers	56%	75%	87%*
Support staff	56%	81%	91%*
Percentage of scheduled patients who have a medical record available at time of appointment	75%	89%	97%*

\*Best value likely to be achieved.

With automation, the average waiting time to answer a call placed in the queue to CAS decreased by 41 seconds. The percentage of time that a queue existed declined; however, the average number of callers in the queue did not change, and the number of patients who reported they had successfully booked an appointment on the first call decreased by 6%. What did improve was patient, care provider, and appointment and scheduling (support) staff satisfaction with the telephone appointment system. TRIPAS also reduced the waiting time in the CAS telephone queue and the average number of calls in the queue.

The average time to book an appointment in CAS dropped from 82 seconds before automation to 78 seconds after automation -- an improvement of 5%. CAS clerks booked appointments at a rate averaging about 10 appointment calls per hour. In the sample clinics, booking time improved in Orthopedics but deteriorated in General Surgery.

Most care providers (96%) and support staff (94%) continued to consider the patient appointment and scheduling function important to the quality of care at Keesler. The level of satisfaction of patients, care providers, and support staff with the overall quality of the appointment and scheduling service had improved by 7-14% at the time of the post-implementation study.

Eighty-seven percent of patients appointed under the automated system had a medical record available at the time of their appointment, compared with 85% in the manual system. There was little variation between systems in care provider and patient satisfaction with availability of medical records.

Patients waited, on average, 29.3 minutes before seeing a care provider with the manual appointment system, and 26.4 minutes with the automated system. Forty percent of appointed patients saw a care provider within 15 minutes of the time of their appointment in the manual system compared with 44% in the automated system. The average no-show rate for patients with appointments remained constant at about 6% for the four clinics sampled. However, there was variation in the magnitude and direction of the change in no-show rates among the clinics.

Based on a design that would track continuity of patient care from primary entry through specialized clinic responses, staff and patients at Keesler were selected and interviewed. In general, interviewers felt that TRIPAS had improved the appointment and scheduling process. The Commander of the Center stated:

All around very helpful. Generally a big plus. It's helped with morale. It makes me smile to see very young techs working the system and becoming proficient in a short period of time. Its reports have brought me closer to the physician staff.

Interviews with patients referred from Primary Care to a specialty clinic (General Surgery and Orthopedics) revealed that once seen in Primary Care, active-duty patients referred to General Surgery waited an average of 3 days for an appointment with manual and automated systems, while non-active-duty personnel waited an average of 5 days (manual) and 6 days (automated) for an appointment.

The cost of an appointment and scheduling transaction within CAS, based on FY 1983 costs and workload, increased from 43 cents to 74 cents with the automated system.

#### Goals and Objectives

Despite the fact that, at the time of the post-implementation study, there were only 3 months' worth of accumulated experience with the system in operation at Keesler, the comparison of the system performance to goals and objectives indicates that at that time, six of the 10 objectives had been met and two more objectives had been partially met. The system had reduced the time to make patient appointments, reduced clinic waiting time, reduced appointment clerical work, increased utilization of providers, reduced appointment errors, and improved interfacility communication. There were indications that the system was going to provide information that would enhance decision making and would help in establishing a data bank of information to use in facilities management.

There was a 2.9% increase in the number of patients who were able to book multiple, same-day appointments. A reduction in no-shows had

not been experienced after three months. Both these impacts require that patients become familiar with the system, that they are knowledgeable about its capabilities, and that they change their behavior. As patients learn that they will be seen at their appointed time and that they are able to make multiple, same-day appointments, it is anticipated that the number of such appointments booked will increase further. A reduction in no-shows would be possible by educating and reminding patients who do not show up for their appointments, whose names would be available from the system, as to the importance of showing up at the appointed time.

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## I. INTRODUCTION

### A. EVALUATION OBJECTIVES

In February 1983, an automated Tri-Service Patient Appointment and Scheduling (TRIPAS) System (initial capability) replaced the manual appointment system at the USAF Medical Center, Keesler Air Force Base (Keesler), Biloxi, Mississippi. This installation was carried out as part of a contract from the Tri-Service Medical Information Systems (TRIMIS) Program Office (TPO). The experience with the implementation of this system is being evaluated in order to provide TPO with information concerning the costs and benefits of providing automated support to patient appointment and scheduling in Military Treatment Facilities (MTFs). The first live day of operation for TRIPAS at Keesler was February 28, 1983. This report presents results of the post-implementation assessment of the automated TRIPAS System at Keesler, and compares these results with previously reported baseline findings<sup>(1)</sup>.

The purpose of this overall evaluation effort, both baseline and post-implementation, is to assess:

- performance and impact of the TRIPAS System; and
- desirable improvements in the TRIPAS System.

The impact of the TRIPAS System was measured by documenting changes in the performance of the appointment and scheduling system between the baseline (manual) and post-implementation (automated) periods. The comparison was accomplished both by measurement of performance indicators and by qualitative assessment of patient and staff perceptions and acceptance of the system. Both quantitative and qualitative information were used to determine to what extent the TRIPAS System has met or exceeded user expectations and goals.

### B. SETTING

USAF Medical Center Keesler is designated as an area medical and consultant center, providing health care to beneficiaries residing throughout the southeastern region of the United States. To accomplish this mission, the medical center currently operates a 325-bed

medical treatment facility, a 50-bed aeromedical staging flight, a 78-room dental treatment facility, and 40 outpatient clinics. The medical center includes approximately 325 officers, 800 enlisted personnel, and 230 civilians. In addition, an average of 105 officers and 30 enlisted personnel are assigned to Keesler for specialized training.

Representative average monthly workload volumes at this facility include 950 inpatient admissions, 34,300 outpatient visits, and 2,250 dental visits. The medical center's ancillary departments also experience heavy monthly workload: 108,000 clinical laboratory procedures, 9,000 dental laboratory procedures, 40,000 radiology procedures, and 55,000 outpatient prescriptions.

#### C. TRIPAS SYSTEM AT KEESLER AFB

The Tri-Service Patient Appointment and Scheduling System provides state-of-the-art automated support to clinic appointment scheduling. The functions supported include appointments, schedules, registrations, medical records, and report generation.

TRIPAS is an adaptation of an automated patient appointment system, the software for which was developed by Medical Data Corporation and acquired by HBO of Atlanta, Georgia. Martin Marietta, of Bethesda, Maryland, is the prime contractor, with HBO the subcontractor responsible for developing and supporting system software. TRIPAS software is written in standard MUMPS.

TRIPAS is an adaptation of an automated patient appointment and scheduling system, the software for which was developed by Medical Data Corporation, currently wholly owned by HBO, Atlanta, GA. Martin Marietta, Bethesda, MD, is the Prime contractor, with HBO the subcontractor responsible for developing and supporting system software. TRIPAS software is written in standard MUMPS. There are three sizes of Data General CPU hardware configuration: large (MV8000); medium (S240); small (S-140).

Keesler received the large configuration, which includes:

<u>Equipment</u>	<u>Number (estimated)</u>
Central Processing Unit (CPU)	1
Line Printer	1
Character Printer	20
Cathode Ray Tube (CRT)	66
Automated Embossing Machine	2

Seven CRTs are located in the Central Appointments Section (CAS) and most of the outpatient clinics will have at least one terminal. The CPU is housed in a specially secured and air conditioned computer room that also houses the CPUs for the TRIPAD and TRIPHARM Systems and will house the TRILAB and CAPOC System's CPUs.

#### D. ORGANIZATION OF THE REPORT

The remainder of this report is divided into three chapters. Chapter II describes the methodology for the evaluation.

Chapter III presents findings, organized into sections that correspond to four steps in the process whereby a patient seeks and then receives outpatient care:

- Requesting an appointment;
- Being scheduled for an appointment;
- Having a medical record located and sent to the appropriate clinic; and
- Receiving care at the appointed time.

For each step of the process, activities involved are described, the results of the baseline evaluation presented, and the implications of these results discussed. The last section in Chapter III presents an analysis of system costs and potential savings.

Chapter IV examines the goals established for the TRIPAS System and compares the benefits derived from the system, as outlined in this assessment, to those goals.

Appendix A contains the composite data compiled from the various questionnaires administered during the post-implementation period.

In both baseline and post-implementation periods, only patient and provider satisfaction were assessed for the Dental Clinic. Although our baseline evaluation reported data for all clinics

including Dental, the Dental Clinic operations are somewhat unique. Therefore, the assessment is more representative of the typical clinic experience if data from the Dental Clinic are analyzed and documented separately. For that reason, a discussion of the Dental Clinic is included as Appendix B.

## II. METHODOLOGY

### A. APPROACH

The overall approach to evaluating the TRIPAS System was a "before and after" study of the performance (effectiveness) and cost of outpatient appointment and scheduling services at Keesler. The basic performance indicators selected for study and evaluation techniques were the same as those employed previously in the focused evaluations at Brooke Army Medical Center and Ehrling Bergquist USAF Regional Hospital<sup>(3)</sup>.

In 1978, the TRIMIS Medical Review Group stated the following goals and objectives for TRIPAS<sup>(4)</sup>:

- Reduced time to make a patient appointment;
- Reduced clinic waiting time;
- Reduced trips to receive care in multiple clinics;
- Reduced appointment clerical work;
- Increased utilization by better matching patients, providers, facilities;
- Reduced "no-shows";
- Reduced appointment transcription and processing errors;
- Improved interfacility communication;
- Enhanced decision making; and
- Establishment of a data bank.

This evaluation was designed to assess -- quantitatively, qualitatively, or by both means -- the ability of TRIPAS to meet each of these objectives.

In order to formulate plans for evaluating the impact of TRIPAS at Keesler, interviews were conducted with Keesler staff during a 2-day site visit on September 9 and 10, 1982. In addition to evaluating the operation of the Central Appointment Section (CAS), evaluation staff selected five outpatient clinics for study: two clinics using CAS to make appointments and three that book their own appointments. In one of the latter, the Dental Clinic, only provider and patient levels of satisfaction were assessed.

Table 1 displays clinic workload, number of assigned providers, and appointment process in each of the clinics that were initially selected for study in this evaluation. The study clinics were selected on the basis of their scheduling methods and the volume of patients seen, especially active-duty personnel. Though the evaluation at Keesler involved a sample of all patients who use the clinics under study, particular attention was given to the impact of TRIPAS on appointment and scheduling activities for active-duty personnel.

Table 2 summarizes the impact areas and evaluation techniques selected for study in this assessment. These areas and techniques were originally outlined in the Evaluation Plan (5).

Baseline data were collected in October 1982, in accordance with the data collection procedures outlined in Table 2. Results of the baseline evaluation were presented in February 1983 (1).

After the system was installed and its operation had stabilized, implementation monitoring was conducted. Working with TPO, 19 criteria and their corresponding measures were developed to determine progress of implementation and system readiness for evaluation. Implementation monitoring was conducted during a 2-day site visit in early April 1983. Data were collected in the five sample clinics, CAS, and Medical Records. TRIPAS System performance criteria and the results of implementation monitoring are displayed in Appendix C. The TRIPAS System met 13 out of 19 criteria that were established for determining readiness for evaluation<sup>(2)</sup>, and a decision was made to collect post-implementation data in May to avoid the inevitable disruption in staff and schedules that occurs over the summer. System operation had stabilized sufficiently for evaluation, even considering its short operating time (3 months) at the time of post-implementation data collection.

#### B. ASSUMPTIONS AND CONSTRAINTS

The following assumptions were made in conducting this evaluation:

- The perceptions of the individuals surveyed accurately assess the functioning of the system. They have had

TABLE 1

CHARACTERISTICS OF CLINICS SELECTED FOR INCLUSION  
IN THE TRIPAS EVALUATION AT USAF MEDICAL  
CENTER, KEESLER AFB

<u>Clinic</u>	<u>Annual Outpatient Visits<sup>a</sup></u>	<u>Number of Assigned Providers<sup>a</sup></u>	<u>Appointment Process</u>
Dental	26,400	22	Books own appointments
General Surgery	29,100	25	Books own appointments
Internal Medicine	8,000	45	Uses CAS
Orthopedics	13,200	5	Books own appointments
Primary Care	51,000	15	Uses CAS

<sup>a</sup> June 16, 1982 survey of clinic workload statistics conducted by  
Keesler hospital services.

TABLE 2

OVERVIEW OF METHODS FOR TRIPAS EVALUATION, USAF MEDICAL CENTER, KEESLER AFB

<u>Impact Area</u>	<u>Measurement Technique</u>	<u>Site</u>	<u>Observation Period</u>
Availability of appointments	Log	CAS	10 days
Total time per appt. transaction:			
a. Response to calls	Time study; telephone monitoring equip't.	CAS, 2 sample clinics	10 days/location
b. Lag before call is answered	Time study	2 sample clinics	10 days/clinic
c. Time/transaction	Time study	CAS, 2 sample clinics	10 days/location
Outpatient waiting time	Time study	4 sample clinics	10 days/clinic
CAS workload	Log; existing statistical reports	CAS	10 days
No. transcription errors/appt. list	Log	4 sample clinics	10 days/clinic
Clinic workload:			
a. Number of scheduled appts.	Log	4 sample clinics	10 days/clinic
b. Number of walk-ins	Log	4 sample clinics	10 days/clinic
c. Number of cancellations	Log	4 sample clinics	10 days/clinic
d. Number of no-shows	Log	4 sample clinics	10 days/clinic
e. Availability of medical records	Survey questionnaire	4 sample clinics	10 days/clinic
f. Availability of x-rays	Survey questionnaire	4 sample clinics	10 days/clinic
Patient perception of scheduling system	Survey questionnaire	5 sample clinics	10 days/clinic
Staff perception of scheduling system:			
a. Telephone clerks and receptionists	Survey questionnaire of all providers & support staff	CAS, 4 sample clinics	NA
b. Providers	Survey questionnaire of all providers & scheduling staff	5 sample clinics	NA
c. Supervisors and administrators	Interviews	CAS; sample clinics (5 base, 4 post); ADM & PA; MR	NA
Cost of scheduling system	Audit of hospital and TPO reports	Hospital; TPO	NA



enough experience with Keesler operations and the patient appointment and scheduling system to have informed opinions concerning system performance.

- The impact of the observers on operations of CAS and the clinics was insignificant.
- The differences observed in MTF operations between the baseline and post-implementation periods were due to the TRIPAS System unless evidence existed to the contrary. If staffing workload, appointment procedures, and patient mix were not equivalent during the two periods, the data analyses were assumed capable of adjustment for the differences or were at least useful in explaining the causes of these differences.
- The impact areas studied accounted for the most significant and meaningful changes occurring as a result of implementing the TRIPAS System at Keesler.
- Sufficient data were collected and Keesler operations were observed for a sufficient amount of time during a reasonably stable time period to accurately reflect normal operations.
- The clinics selected for study were typical of the methods of operation throughout Keesler Medical Center.

These assumptions appear reasonable for an evaluation of this type (before-after) and duration (10-day data collection period).

Three major constraints have been identified in the conduct of this study:

- In order to keep evaluation costs reasonable, data were not collected at a "control" MTF, e.g., one that is not implementing a TRIPAS system; thus, the evaluation is not a classical, more definitive "before-after" case control study.
- Beginning in May of every year, there is turnover of physicians and other health care providers at Keesler;

thus, some baseline study participants were lost to follow-up in the post-implementation survey.

- Workloads were not equal in the baseline and post-implementation periods:
  - After the baseline period one clinic (ENT) switched from booking its own appointments to having CAS book them.
  - Questionnaire results revealed that up to one third of the patients in clinics that booked through CAS were being appointed instead by clinic personnel using the automated system; this phenomenon may have reduced CAS workload in the post-implementation period.

Despite these complications, execution of the study design appears to have fulfilled the evaluation objectives of this project.

#### C. DATA COLLECTION

Baseline data collection began on October 4, 1982, and continued to the end of the month. Implementation monitoring conducted during April 1983 indicated that the TRIPAS System was ready for evaluation. Post-implementation data collection was conducted from May 16 to May 27, 1983. Previous staff experience on site contributed to efficient data collection during the post-implementation period.

Beginning on May 16, 1983, post-implementation data were collected in the five sample clinics and CAS for 10 days. All data were recorded by evaluation team members or hired and closely supervised data collectors, with the exception of cost data and reports concerning availability of clinic appointments, which were obtained from TRIMIS records and existing hospital reports. Prior to implementation of data collection, on-site data collectors (primarily off-duty Red Cross volunteers who were familiar with Keesler operations and had collected baseline data) were briefed by staff from National Capitol Systems, Inc. (NCSI) on data collection procedures, given a demonstration, and then checked for proficiency and accuracy as they performed the data collection tasks.

The number of observations made during both baseline and post-implementation periods is included as Table 3.

Data concerning the availability of appointments and workload were collected at CAS and in the two clinics that book their own appointments (Orthopedics and General Surgery). Clerks recorded all incoming calls by maintaining logs by type of call: appointment booked, appointment not available, appointment cancelled, appointment verified, or information given. Data collectors also maintained records of kept and unkept appointments, and walk-in patients, in the four sample clinics, and tracked sample patients through the Primary Care Clinic screening process to diagnosis and treatment in another appropriate clinic. This tracking facilitated the assessment of the availability of appointments from a continuity of care perspective.

An automated system in use at Keesler records the amount of time patients calling CAS wait before the telephone is answered. This information was provided at regular intervals throughout the day. This system eliminated the need for data collectors to make on-base calls to gather information on caller waiting times.

In order to measure the amount of time spent in the appointment and scheduling process, direct observation of hospital activities was performed. Timed observations were made to record patient waiting times in the clinics. The time required to reach a CAS clerk on the telephone and the amount of time required to book an appointment were measured.

Two physicians per clinic were interviewed in order to gather information regarding physician productivity as well as the provider perspective on the availability of appointments.

To calculate physician productivity, data were collected on the average number of patients physicians saw per working hour during the post-implementation study and this figure was compared with the baseline figure. Because some physicians were not available in both periods, data from a sample of eight full-time non-resident physicians was initially available for analysis. These data showed that the average number of patients seen per hour by these eight physicians

TABLE 3

NUMBER OF BASELINE AND POST-IMPLEMENTATION OBSERVATIONS MADE,  
TRIPAS EVALUATION, USAF MEDICAL CENTER, KEESLER AFB

Impact Area	Baseline				Post implementation							
	CAS	IM	PC	GS	O	D	CAS	IM	PC	GS	O	D
Total time per appt. transaction:												
a. Response to calls	550	NA	NA	76	193	NA	386	NA	NA	74	157	NA
b. Lag before call is answered	0	NA	NA	0	0	NA	0	NA	NA	0	0	NA
c. Time/transaction	846	NA	NA	449	593	NA	817	NA	NA	455	365	NA
Outpatient waiting time	NA	336	353	330	322	NA	NA	109	114	121	120	NA
CAS workload	9404	NA	NA	NA	NA	NA	7380	NA	NA	NA	NA	NA
No. transcription errors on daily clinic appt. lists	NA	4	192	2	3	NA	NA	4	7	1	22	NA
Clinic workload:												
a. Number of scheduled appts.	NA	423	2239	448	600	NA	NA	434	1854	454	406	NA
b. Number of walk-ins	NA	451	80	147	288	NA	NA	561	397	39	260	NA
c. Number of cancellations	NA	14	103	30	39	NA	NA	15	110	17	26	NA
d. Number of no-shows	NA	23	116	11	74	NA	NA	30	71	42	29	NA
e. Availability of medical records	NA	840	2290	554	777	NA	NA	950	2070	434	611	NA
f. Availability of x-rays	NA	830	NA	554	777	NA	NA	950	NA	434	611	NA
Patient perception of scheduling system	NA	170	190	149	166	105	NA	124	128	127	131	88
Staff perception of scheduling system:												
a. Telephone clerks & receptionists	5	6	13	7	10	NA	7	3	11	4	9	NA
b. Providers	NA	20	13	12	7	26	NA	10	13	7	5	25
c. Supervisors and administrators	1	1	1	1	1	1	1	1	1	1	1	1

KEY: CAS = Central Appointment Section; IM = Internal Medicine; PC = Primary Care; CS = General Surgery; 0 = Orthopedics; D = Dental.

increased from 3.04 in the baseline to 3.27 at the time of the post-implementation study. While the observed change was relatively small (.23 patients per hour per physician increase), the resulting value of this benefit is extremely sensitive to small variations and could produce very large benefits for TRIPAS.

Because this preliminary estimate was based on such a small sample of physicians, additional data were obtained. Data reflecting all outpatient visits and physician hours spent in the 23 clinics at Keesler AFB were obtained for both October 1982 and October 1983. The number of visits per hour was calculated for each clinic pre and post the implementation of the PAS system. A two-tailed t-test was performed on the data. The difference was found to be statistically significant at the .01 level. The mean number of visits per hour in all Keesler Clinics by all providers in October was 1.84 before PAS and 2.15 after PAS, resulting in an average increase of .31 patients per physician hour. (See Appendix D for detailed data on provider productivity and related statistical analysis.)

Keesler financial records were reviewed in order to determine the number of scheduling personnel and their salaries, the costs of equipment and supplies, and the costs of base overhead support. A review of TRIPAS System procurement costs was performed to calculate post-implementation systems costs. This provided cost data from which the cost per unit of workload (cost per appointment, cost per appointment transaction) was determined.

Surveys were used to assist in establishing performance criteria and to measure satisfaction with current services. Patients, providers, and scheduling staff in all five study clinics were surveyed by use of a self-administered questionnaire. These questionnaires contained questions concerning satisfaction with various aspects of the appointment and scheduling system and concerning performance goals for the system, and open-ended questions about system improvement.

Supervisors and administrators in the five study clinics, CAS, Medical Records, Patient Affairs, and Administration were interviewed regarding their satisfaction with the automated patient appointment

and scheduling system and their suggestions for improvements. They were asked in what ways had TRIPAS improved clinic efficiency and their clinical effectiveness.

Data collection activities were completed in May 1983. Data coding and analyses were completed in June 1983 and this report was prepared in August 1983.

#### D. ANALYSIS

Analysis of the data was of two general types:

- Comparisons of post-implementation results with baseline results for the same impact; and
- Comparisons of baseline and post-implementation results with performance goals set by Keesler staff, and with system goals and objectives set by the Medical Review Group.

For both types of analysis quantified results are presented side by side and improvement or deterioration in performance discussed. Results were analyzed for each clinic and CAS as well as aggregated for all clinics. In general, impacts are clustered in one of five sections of this report:

- Requesting an appointment;
- Being scheduled for an appointment;
- Having the medical records located and sent to the appropriate clinic;
- Receiving care at the appointed time; or
- Cost of appointment and scheduling operations.

Where the differences between observation periods required interpretation, statistical tests were performed (chi-square, t-tests) to assess the significance of differences between performance periods. Differences in average clinic waiting time to see a care provider, for example, were considered significant if the probability of the difference occurring by chance was less than one in twenty ( $p < 0.05$ ). Sufficient samples were collected in both observation periods to detect differences at this significance level. The data compared for

quantified impacts, in general, involved stratified means and standard deviations.

Questionnaire data were keypunched, edited, and analyzed using a standard statistical computer program. A Likert Scale was used to record responses concerning importance of and satisfaction with the appointment system into mean ratings.

The performance goals defined by Keesler staff were set for three levels:

- Minimum acceptable.
- Average expected.
- Maximum attainable.

Comparison of baseline and post-implementation results with these levels of anticipated performance (as determined in a provider survey) allowed an assessment of how well the TRIPAS System met user expectations. These analyses provided a second method of interpreting the significance of changes in performance between the manual and automated system. Performance goals were established for about one-third of the TRIPAS impacts that were assessed.

Qualitative data obtained from the questionnaires generally fell into five categories: "very" or "somewhat" positive, neutral, and somewhat or very negative. For this evaluation, the very and somewhat positive responses have been combined into one positive figure indicating an acceptable level of satisfaction or importance.

In general, baseline results were compared with post-implementation results. In order to perform this comparison, similar analytical methods have been applied to the data for both periods. In some cases this has required recalculation of baseline results in order to ensure that the data are comparable. Baseline results for some variables may therefore vary somewhat from those same variables as reported in the baseline evaluation (1).

### III. RESULTS

This chapter presents the results of the post-implementation (automated system) study of the patient appointment and scheduling system at Keesler. The discussion is organized according to stages in the appointing and care delivery process. Each section describes the activity involved, presents quantitative findings and then questionnaire or interview responses, and finally discusses the conclusions derived from these results.

#### A. REQUESTING AN APPOINTMENT

##### 1. Description of the Process

During the time of the post-implementation study, patients at Keesler Medical Center could make an appointment in person and by telephone, but most appointments were made by telephone. Patients called either CAS or the appropriate clinic, depending on whether appointment scheduling was done centrally or in the clinic. Calls into CAS were made either from off-base telephones or from special telephones located at convenient places around Keesler. During peak scheduling periods (for example, early morning hours or days when new schedules were made available), patients calling from off base were likely to encounter either a busy signal, which indicated that all telephone lines into CAS were busy, or a recorded message, which meant that all available telephone clerks were busy. CAS was open from 0730 to 1600, Monday through Friday. Clinics that scheduled their own appointments did so during normal clinic hours (0800-1600).

##### 2. Time Required to Have a Call Answered

Keesler Medical Center has an automated telephone monitoring system which permits the supervisor of CAS to assess, at any time of the day, the number of persons waiting in queue to have their calls answered. The queue has a limit of 15 calls at any one time. In order to estimate the average number of persons waiting in the queue, data collectors queried the automated telephone system once every half hour from 0730 to 1600 for a 10-day period. Results are summarized in



Table 4. Analysis is divided into two types of averages: the mean over all observations, and average readings only when a queue existed.

The percentage of observations where a queue existed decreased in the post-implementation period from 36% to 23%. The average number of callers in the queue over all observations was 1.7 (manual) and 1.1 (automated). The average number of callers waiting in queue during the intervals when a queue existed was slightly less than five in both periods.

The telephone monitoring system also permitted measurement of the number of seconds the first person in the queue had been waiting. This figure decreased from 42 seconds for all baseline readings to 18 seconds for post-implementation readings. The average for observations only when a queue existed dropped from 117 seconds to 76 seconds in the post-implementation study period.

### 3. Patient Opinions About Telephone Access to Appointments

#### a. Number of Attempts Made Before Getting an Appointment

Forty-one percent of the patients responding to the Outpatient Questionnaire (see Appendix A) reported that they had scheduled their appointments through CAS; this percentage was down from 52% in the baseline period. The remainder scheduled their appointments through the clinics. Table 5 breaks out the calls made to CAS by clinic and shows the number of calls a patient had to make before getting through to a CAS clerk: in the baseline period, 44% of the patient respondents needed one telephone call to make their appointments; 16% called twice and 15% required three calls. During the post-implementation evaluation, the figures showed access was not quite as good: 38% needed only one call, 19% required two calls, and 19% made three attempts before getting through to the appointment desk. When these responses were broken down by clinic, the largest proportion in most clinics made only one attempt to make an appointment; in the Internal Medicine clinic, however, the largest percentage made more than three attempts. These proportions were true during the baseline evaluation as well.

TABLE 4

AVERAGE NUMBER OF CALLERS WAITING AND  
AVERAGE LENGTH OF TIME TO REACH CAS,  
TRIPAS EVALUATION, USAF MEDICAL CENTER, KEESLER AFB

	<u>Evaluation</u>		<u>Change</u>
	<u>Base</u>	<u>Post</u>	
Percentage of time that a queue existed, by half-hour segments (0730-1600)	36	23	-13 percentage points
Average number of CAS callers waiting in queue, all observations	1.7	1.1	-0.6 calls
Average waiting time in queue for CAS caller, all observations (in seconds)	42.1	17.7	-24.4 sec
Average number of CAS callers waiting in queue, when queue existed	4.8	4.7	-0.1 callers
Average waiting time in queue for CAS caller, when queue existed (in seconds)	116.6	75.9	-40.7 sec

KEY: Base = baseline (manual system) study.

Post = post-implementation (automated system) study.

TABLE 5

NUMBER OF ATTEMPTS BEFORE GETTING THROUGH TO CAS,  
TRIPAS EVALUATION, USAF MEDICAL CENTER, KEESLER AFB

Number of Keesler attempts	<u>Int'l Med.</u>		<u>Prim. Care</u>		<u>Genl. Surg.</u>		<u>Orthopedic</u>		<u>All</u>	
	<u>Base</u>	<u>Post</u>	<u>Base</u>	<u>Post</u>	<u>Base</u>	<u>Post</u>	<u>Base</u>	<u>Post</u>	<u>Base</u>	<u>Post</u>
1	16.9	21.2	52.3	44.9	53.8	34.3	51.0	56.4	44.2	38.4
2	22.1	15.2	11.9	18.4	20.5	34.2	14.3	15.4	15.6	19.4
3	19.5	21.2	14.9	17.2	15.4	25.7	10.2	12.8	15.3	18.9
more than 3	36.3	40.9	17.3	13.8	10.3	2.9	16.3	12.8	20.7	19.4
can't remember	5.2	1.5	3.6	5.7	0.0	2.9	8.2	2.6	4.2	3.5

KEY: Base = baseline (manual system) study.

Post = post-implementation (automated system) study.

#### b. Satisfaction with Telephone System

Patients were asked to rate their satisfaction with the telephone system for making appointments. In the baseline study, 57% responded that they were satisfied; 61% expressed satisfaction in the post-implementation period. The telephone system was the lowest rated aspect of the Keesler health care experience during the baseline period; after implementation, only parking received a lower rating.

#### 4. Provider Opinions About Telephone System

Provider opinions concerning the telephone system for making appointments were obtained from the Provider Questionnaire (see Appendix A). The questionnaire asked providers in Orthopedics, General Surgery, Internal Medicine, Primary Care, and the Dental Clinic to rate their satisfaction with various aspects of the scheduling system and to make suggestions for improving the system. Only 27% of the medical providers (in all clinics except Dental) were satisfied with the telephone system during the baseline period, but this percentage rose to 40% after system implementation. The telephone system was the least satisfactory aspect rated by the medical providers in the baseline period. While the 40% satisfaction level is still low, it ranked higher than three other facets (availability of x-rays, same day multiple clinic visits, and patients requiring immediate appointments) of the health care system in the post-implementation period.

#### 5. Support Staff Opinions About the Telephone System

Support staff opinions were obtained from the Appointment and Scheduling Support Staff Questionnaire (see Appendix A).

Of the respondents in the baseline period, 65% were satisfied with the telephone system. This satisfaction level increased after implementation to 74%. While their satisfaction with the telephone system was low relative to the other aspects they rated, support staff were less critical about it than providers or patients.

#### 6. Conclusions

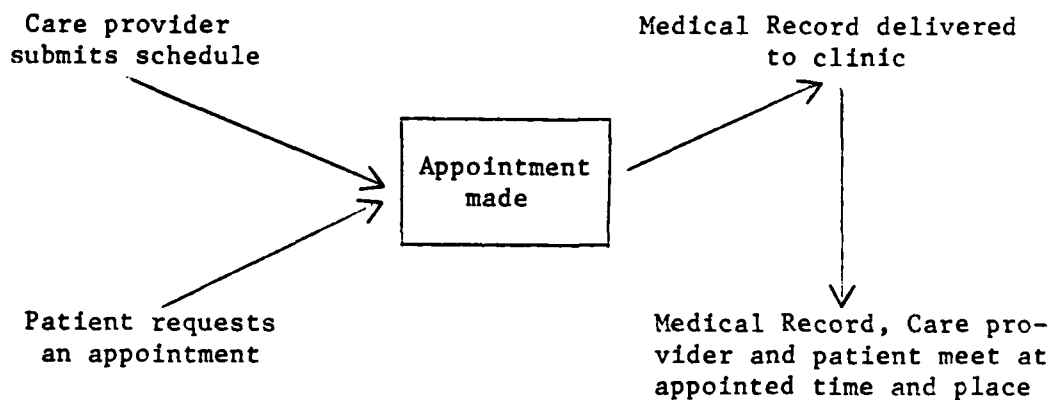
Telephone access to CAS, as measured by the telephone monitoring system (Table 4, above), improved during the post-implementation period. Results from the Outpatient Questionnaire, however, show that

the percentage of callers that got through to CAS on their first attempt decreased by 6% after implementation. In spite of this perceived decrease in system quality, the most consistent finding proved to be the increase in satisfaction levels for patients, providers, and appointment staff. While the levels were still not high compared to other aspects of the health care system, all three groups expressed greater satisfaction with the telephone system after implementation of the automated system. Structural limitations within the phone system may preclude very high levels of satisfaction: some callers are always going to be in the queue. It is clear, however, that since the introduction of the TRIPAS System telephone transactions have generated less dissatisfaction for staff, providers, and patients alike.

## B. BEING SCHEDULED FOR AN APPOINTMENT

### 1. Description of the Process

A simple diagram of the patient appointment and provider scheduling process is:



Though this process appears to be straightforward, in reality it involves a labor-intensive, time-consuming set of transactions involving multiple records of the appointments that are made, cancelled, and changed. In addition to the actual appointment process the appointment system must interface with the medical record system to transfer a medical record from the Medical Records Department to the appropriate clinic before the patient arrives.

next available appointment with a given provider or clinic. The software also permitted the clerk to examine a given day's list of appointments and openings. Once the patient's Social Security number was given, the clerk could search the patient data base for the correct patient information. If a patient was already registered, the patient information needed to make an appointment (given orally by the caller under the manual system) appeared on the screen. Thus, the potential existed for significant time savings per transaction when a patient was preregistered. Illegible entries or misspellings were practically eliminated since no handwriting was involved. Cancellations and changes in provider schedules were accomplished more easily because they did not require manual crossing out.

During the baseline evaluation period CAS averaged roughly 940 calls per day; during the post-implementation period the average was 738 (see Table 6). This level of activity is normally handled by five operators. Each clerk is expected to book about 100 appointments a day on average. During the baseline evaluation period, clerks averaged 200 calls and 107 appointments booked daily. These figures decreased in the post-implementation period to 139 calls and 73 appointments booked daily. This decrease can be explained, in part by results from our patient survey that revealed that up to one-third of patients appointed to clinics that booked through CAS were being appointed instead by clinic personnel using the automated system.

#### b. Clinics

The evaluation at Keesler included two specialty clinics: General Surgery and Orthopedics. These clinics booked their own appointments and did not utilize CAS. For a patient to be seen in General Surgery and Orthopedics, that individual first had to be seen in the Primary Care clinic and then referred to the specialty clinic. Once they had been referred, patients usually booked appointments in person or by calling the clinic directly. The appointment clerk requested the relevant information from the patient to determine the nature of the medical need. Care provider schedules were then reviewed and an appointment was scheduled at the earliest possible date.

At Keesler appointments were booked by either CAS or the individual clinics. Different procedures were followed depending on whether CAS or the clinic made the appointment.

a. CAS

Under the manual system at Keesler, monthly provider schedules were submitted to CAS several weeks in advance. CAS staff maintained notebooks for each provider and relevant clinics that listed the available routine appointment slots and the time set aside for acute problems. CAS also kept a separate list of the present and next day's appointments and available open slots.

Under the manual system, appointment clerks at Keesler sat around a rotary carousel as they received incoming calls. When an appointment was requested, the operator searched for the appropriate notebook in the carousel, secured it if it was not being used by another clerk, or waited until it became available. When a time and day for the appointment had been settled on, the clerk asked a prescribed set of questions (including registration information) necessary to complete the transaction. The clerks then gave a set of oral instructions about clinic locations and preparation the patient must make and had the caller repeat the details of the appointment. The operator wrote the necessary information into the appointment book while speaking with the caller and then returned it to the proper slot in the carousel.

Two days before the appointment date, the Daily Register was sent by CAS to Medical Records. The Medical Records Department then pulled patient records from the Daily Register patient appointments and sent these registers and the pulled records to the appropriate clinic on the day before the patient's appointment.

CAS clerks kept daily manual records of the number and type of transactions they processed. From these records, supervisors produced summary documents of hospital appointment activity through CAS.

Under the automated system, no carousel was necessary. The operators had their own stations, each equipped with a CRT terminal. When a call was answered, operators used their terminal to find the

TABLE 6

NUMBER OF CALLS RECEIVED BY CAS,  
TRIPAS EVALUATION, USAF MEDICAL CENTER, KEESLER AFB

<u>Type of Call</u>	<u>Baseline</u>	<u>Post-impl.</u>
Appointment Made	5040	3861
Information	3140	1601
Appt. Unavailable	823	1598
Appt. Cancelled	181	320
Appt. Rescheduled	220	1315
Total	9404	7380

NOTE: Because both the baseline and post-implementation data collection period was 10 working days, daily averages can be determined by dividing the total number of monitored calls by 10.



Priority was given to active-duty personnel; they were routinely seen within 24 hours of referral.

Under the automated system, the clinics made use of terminals usually located at the receptionists' desks. Receptionists continued to perform a variety of tasks, only some of which were related to appointments and scheduling. Information regarding appointments and registration data were obtained by a few keystrokes in the automated system. In some cases, patients who were asked by a physician to return the next day at a particular time were promptly booked by the clinic into the automated system; under the manual system this arrangement might have gone unnoted. Other changes observed included periodic use of the clinic printers to produce lists of patients by provider, and provider use of the system to check the availability (for referrals) of open appointments for providers in other clinics.

## 2. Time Spent on Appointment Activities

### a. CAS

Telephone calls to CAS were monitored in order to determine the time required to book appointments and conduct other types of scheduling transactions. Data summarizing the number of calls received by CAS are reported in Table 6 (above), and data on the length of monitored telephone calls are included in Table 7.

The distribution of calls sampled by type differed in the post-implementation period from the baseline distribution. There were fewer appointment-made and information calls and twice as many appointment-unavailable transactions in the post-implementation period. As shown in Table 6, the number of information calls dropped sharply. This decrease may reflect the cyclical phenomenon of the increased experience patients had with Keesler's health care system in May as opposed to their lack of familiarity in the preceding October. [As in any military base, many new families are reassigned to Keesler during the summer months, and they undergo an adjustment period while they learn about how to properly use base services.]

The average time to complete a CAS telephone transaction decreased from 67 to 60 seconds. All types of CAS transactions (except

TABLE 7

LENGTH OF TELEPHONE CALLS TO CENTRAL APPOINTMENT SECTION,  
TRIPAS EVALUATION, USAF MEDICAL CENTER, KEESLER AFB

<u>Type of Call</u>	<u>No. (and %) of Observations</u>		<u>Mean (seconds)</u>		<u>Change (sec)</u>
	<u>Baseline</u>	<u>Post-impl.</u>	<u>Base</u>	<u>Post</u>	
Appointment Made	550 (65)	476 (59)	82.1	78.1	-4.0
Information	189 (22)	129 (16)	29.0	20.6	-8.4
Appt. Unavailable	94 (11)	191 (23)	57.2	40.0	-17.2
Appt. Cancelled	7 (1)	14 (1)	43.0	36.1	-6.9
Appt. Rescheduled	6 (1)	7 (1)	79.5	94.1	+14.6
All Transactions	846 (100)	817 (100)	67.2	59.5	-7.7

KEY: Base = baseline (manual system) study.  
Post = post-implementation (automated system) study.

appointment rescheduling, which represented only 1% of all calls) took less time to complete. An appointment booking took 4 seconds less on average during the automated evaluation period. The greatest single decrease was in calls where an appointment was not available to the caller, down to 40 seconds on average from 57 seconds in the baseline period.

To make results comparable, the baseline distribution of telephone calls was used as the standard to calculate and compare overall averages of time per CAS transaction.

b. Clinics

The average time to complete a telephone transaction in the Orthopedics Clinic (see Table 8) decreased between the manual and automated evaluations from 147 seconds to 125 seconds. Information calls lasted 26 seconds less on average after implementation of the automated system, and booking an appointment took 35 seconds less. The distribution of Orthopedics phone calls by type of call during the post-implementation period was different from the baseline period in that there were many more appointment-made transactions and fewer information and appointment-unavailable calls. Information calls accounted for 50% of the transactions in the baseline period, and 32% in the post-implementation period; the percentage of appointment-made calls rose from 32% to 43%.

The General Surgery Clinic (Table 9) experienced an increase in the time spent in appointment activities. The distribution of calls was virtually the same during both periods (information calls about 80%, appointment bookings roughly 17%), and the average transaction time rose from 74 seconds to 86 seconds. Appointment bookings accounted for most of the increase. On average, it took just over 1 minute longer to book an appointment in the General Surgery Clinic after implementation of the automated system due to administrative changes internal to this clinic that had little to do with TRIPAS.

TABLE 8

LENGTH OF TELEPHONE CALLS TO ORTHOPEDICS CLINIC,  
TRIPAS EVALUATION, USAF MEDICAL CENTER, KEESLER AFB

<u>Type of Call</u>	<u>No. (and %) of Observations</u>		<u>Mean (seconds)</u>		<u>Change (sec)</u>
	<u>Baseline</u>	<u>Post-impl.</u>	<u>Base</u>	<u>Post</u>	
Appointment Made	193 (32)	157 (43)	201.3	166.7	-34.6
Information	294 (50)	116 (32)	113.3	87.4	-25.9
Appt. Unavailable	41 (7)	65 (18)	117.3	136.8	+19.5
Appt. Cancelled	29 (5)	12 (3)	79.0	135.3	+56.3
Appt. Rescheduled	36 (6)	15 (4)	223.4	193.4	-30.0
All Transactions	593 (100)	365 (100)	147.2	125.0	-22.2

KEY: Base = baseline (manual system) study.

Post = post-implementation (automated system) study.

TABLE 9

LENGTH OF TELEPHONE CALLS TO GENERAL SURGERY CLINIC,  
TRIPAS EVALUATION, USAF MEDICAL CENTER, KEESLER AFB

<u>Type of Call</u>	<u>No. (and %) of Observations</u>		<u>Mean (seconds)</u>		<u>Change (sec)</u>
	<u>Baseline</u>	<u>Post-impl.</u>	<u>Base</u>	<u>Post</u>	
Appointment Made	76 (17)	74 (16)	130.4	192.2	+61.8
Information	359 (80)	370 (81)	61.4	63.8	+2.4
Appt. Unavailable	7 (2)	4 (1)	115.1	70.3	-44.8
Appt. Cancelled	6 (1)	5 (1)	46.8	67.8	+21.0
Appt. Rescheduled	1 (1)	2 (1)	180.0	134.0	-46.0
All Transactions	449 (100)	455 (100)	74.0	86.1	+12.1

KEY: Base = baseline (manual system) study.

Post = post-implementation (automated system) study.

### 3. Staff Productivity

The number of telephone transactions in the CAS was recorded by type of call on workload logs filled out by each clerk in the baseline period. A combination of logs and TRIPAS System reports was used to compile post-implementation figures.

The average number of CAS telephone transactions per day on the manual system was 940 (see Table 6, above). This figure declined after implementation of the automated system to 738 calls per day. The average number of appointment bookings per day dropped from 504 (baseline) to 386 (post-implementation). The three highest baseline figures for appointments booked per day by a single CAS clerk were 251, 195, and 170. The three highest corresponding post-implementation figures were 149, 145, and 144. The mean number of transactions per clerk per hour decreased from 27 to 19 between evaluation periods. These data reflect the smaller volume of incoming calls, rather than a decline in productivity.

### 4. Patient and Staff Opinions

#### a. Patients

Outpatients in the four sample clinics were asked their opinions of the appointment and scheduling system. They were asked basic information about how and when their appointments were made, as well as their degree of satisfaction with the various aspects of the health care system. (See Appendix A for a composite of the results of this questionnaire and Table 10 for selected results.)

When asked when they had scheduled their appointments, 56% of the patients in the baseline period replied that they had booked them a week or less in advance, compared to 47% of the post-implementation respondents. The percentage of patients who had made their appointments more than 2 weeks before was 28% (baseline) and 27% (post-implementation). About 70% of respondents from both study periods would have preferred an appointment sooner, and there was an approximately 2.92% increase (from 6.3% to 9.2% observed for the post-implementation period) in the number of patients who had same day multiple clinic appointments.

Patient satisfaction with the appointment and scheduling system in general rose in each of the four clinics. The satisfaction level for the clinics taken as a whole increased by 7% (Table 10). Patients were asked to rate their satisfaction with three specific aspects that directly contributed to their satisfaction with the appointment system in general: ease of booking appointments, availability of appointment at time desired, and performance of the telephone system. While satisfaction with ease of booking and with availability of appointments at the time desired remained the same, telephone satisfaction improved and may have contributed to the 7% increase in satisfaction with the system as a whole. The clinic that showed the most improvement (Internal Medicine) had the lowest baseline satisfaction ratings. That clinic's level of satisfaction with the telephone system and the appointment and scheduling process increased from 47% to 55% and from 54% to 63%, respectively.

The Dental Clinic was evaluated for patient satisfaction. A discussion of these data is included in Appendix B.

b. Providers

Opinions about baseline scheduling services were obtained from 52 medical providers in four clinics using the Provider Questionnaire (see Appendix A). The same survey questions were also asked of 35 providers in the post-implementation study. In the baseline study, providers were asked to set goals for provider satisfaction with the overall quality of the appointment system. They set a minimum level of 57% satisfied with the system, a standard of 75% and a maximum expected level of 87%. Table 11 shows provider opinion about appointment services in the two study periods.

The most striking improvement (21%) was in the providers' perceptions that patients were having an easier time booking appointments with the automated system. Providers also felt that more patients could book appointments when they wanted (15%), and that the telephone system had improved (13%). Although providers also felt that patients were less able to book an appointment on an immediate basis (a decrease of 11%), overall their levels of satisfaction with the

TABLE 10

PATIENT SATISFACTION WITH APPOINTMENT SYSTEM,  
TRIPAS EVALUATION, USAF MEDICAL CENTER, KEESLER AFB

Service Aspect	Percentage of Respondents Expressing Satisfaction									
	Booked by Clinic				Booked by CAS					
	Gen'l Surgery		Orthopedics		Primary Care		Int'l Medicine		Total	
	Base	Post	Base	Post	Base	Post	Base	Post	Base	Post
Ease of booking appointments	75	76	76	71	76	81	57	56	71	71
Availability of appointment at time desired	78	75	64	63	82	78	54	61	70	69
Telephone system for making appointments	57	59	58	63	67	68	47	55	57	61
Appointment and scheduling system in general	72	79	64	70	71	78	54	63	65	72
Overall experience with care system	89	88	72	75	81	76	88	93	82	83

KEY: Base = baseline (manual system) study.  
Post = post-implementation (automated system) study.



TABLE 11

PROVIDER SATISFACTION WITH APPOINTMENT SYSTEM,  
TRIPAS EVALUATION, USAF MEDICAL CENTER, KEESLER AFB

<u>Impact Area</u>	<u>Net Percent Satisfied</u>		<u>Change</u>
	<u>Baseline</u>	<u>Post</u>	
Patients' ease of booking appts.	39	60	+21 percentage points
Patients' ability to book appts. at time desired	40	55	+15 percentage points
Waiting time after arrival	75	80	+5 percentage points
Telephone system for making appts.	27	40	+13 percentage points
Accuracy of assigning patients to appropriate clinic	70	76	+6 percentage points
Ability of appointment and scheduling system to accommodate:			
Flexible schedules	45	53	+7 percentage points
Patients requiring immediate appointments	42	31	-11 percentage points
Importance of appointment and scheduling services	92	96	+4 percentage points
Overall quality of appointment and scheduling services	49	63	+14 percentage points

NOTE: The number of respondents in the baseline period was 52; in the post-implementation period, 35.

appointment and scheduling system increased comfortably with the automated system, from 49% satisfied in the baseline period to 63% with the TRIPAS System.

Providers were queried as to how important they felt the patient appointment and scheduling system was to the quality of care delivered at Keesler. Of the 26 providers who responded to this question, 96% felt it was important; only one disagreed.

Provider comments about the TRIPAS System, supplied in the "Additional comments" section of the survey and in personal interviews, were also supportive: "It increases my efficiency. Since I don't have a secretary, it makes a big difference to me. I'm happy with the thing." Another provider commented that TRIPAS had "made it easier for me to anticipate the next day's workload."

Opinions of providers in the Dental Clinic were also solicited; responses from that clinic are in Appendix B.

#### c. Support Staff

Support staff were surveyed about the importance of the appointment and scheduling system to the quality of care, their satisfaction with the various aspects of the appointment and scheduling system, and their suggestions for improving the system. Table 12 shows support staff opinions about the appointment system in the two study periods. Every aspect examined showed an improvement over the baseline period. The most notable changes were the ability of the system to change provider schedules and to enable patients to book appointments when they wanted, but the overall consistent and steady improvement in all areas is perhaps the most striking aspect.

Some staff comments on the automated system are revealing: the chief nurse in Primary Care said, "It's improved the utilization of appointment times, and it's improved accountability. But we have ended up making more appointments than we should be making." The manager of CAS likewise commented, "The PAS System has greatly improved the efficiency of obtaining available appointments, and has been advantageous to patients and providers. Appointments can be made

TABLE 12

SUPPORT STAFF SATISFACTION WITH APPOINTMENT SYSTEM,  
TRIPAS EVALUATION, USAF MEDICAL CENTER, KEESLER AFB

<u>Impact Area</u>	<u>Net Percent Satisfied</u>		
	<u>Baseline</u>	<u>Post</u>	<u>Change</u>
Patients' ease of booking appts.	63	82	+19 percentage points
Patients' ability to book appts. at time desired	55	85	+30 percentage points
Telephone system for making appts.	65	74	+9 percentage points
Ability of appointment and scheduling system to accommodate:			
Flexible schedules	44	76	+32 percentage points
Patients requiring immediate appointments	66	82	+16 percentage points
Relative ease for staff to:			
Book appointments	77	91	+14 percentage points
Cancel appointments	74	97	+23 percentage points
Reschedule appointments	77	88	+11 percentage points
Dispense information to patients	69	76	+7 percentage points
Importance (% of respondents feeling system is important)	93	94	+1 percentage points
Overall satisfaction	75	88	+13 percentage points

NOTE: The number of respondents in the baseline period was 41; in the post-implementation period, 34.

in more than one location. This allows greater access for everybody involved."

## 5. Conclusions

The TRIPAS System was expected to decrease the time spent in appointment activities. The data collected in the Central Appointment Section support this hypothesis. The overall transaction time within CAS decreased an average of 7 seconds per call. Data from the clinics gave mixed results: in one clinic transaction time increased, in another it decreased. Patients, providers, and support staff reported greatly increased satisfaction with the appointment process.

During the post-implementation study period, CAS received fewer calls than in the baseline study period. Because of this, impact of the reduced transaction time on improved peak period performance or better phone access to CAS could not be documented. But it can be assumed that during a period of increased workload the shorter transaction times with TRIPAS would result in more efficient and expeditious clerk performance.

The opinions of the support staff provide some insight into this same issue (decrease in telephone calls to CAS). It seems likely that more appointments--particularly follow-up visits--are being scheduled by staff at individual clinics, even when those clinics normally use CAS; the increased ease of booking appointments under TRIPAS may be a factor in this shift.

## C. HAVING THE MEDICAL RECORD LOCATED AND SENT TO THE APPROPRIATE CLINIC

### 1. Description of the Process

Under the manual system the Medical Records Department at Keesler had three shifts: day (0800-1600), night (1600-2400), and midnight (2400-0800). The morning shift pulled the medical records for afternoon appointments on the same day, and the midnight shift pulled the medical records for appointments the next morning. Clinic staff picked up the records for their respective clinics. CAS clerks completed the Medical Record Request Form (Form 250) for all persons to be seen in Primary Care. These forms were left in a box in CAS to

be picked up daily by a staff person from the Medical Records Department. All Form 250s for afternoon appointments were picked up by 10:00 a.m. so that records could be forwarded to Primary Care.

The installation of TRIPAS resulted in a reorganization of duties among the three shifts; with TRIPAS, the day shift pulled medical records for walk-in patients; the night shift put away records from the day's appointments; and the midnight shift pulled records for the next day's appointments. With the TRIPAS System the Medical Records Department generated the Medical Records pull list for each clinic 16 hours in advance of the appointment day. The pull list consists of three components: a written-out list by provider and clinic; charge-out cards; and provider schedule by provider and clinic.

## 2. Availability of Medical Records

Data on the availability of medical records at the time of the patient's appointment, which were collected during both study periods, are shown in Table 13. Overall, medical records were available for 87% of the patients observed during the post-implementation period as opposed to 85% during the baseline period. Internal Medicine had the highest medical record availability (96%) during the post-implementation period. This represents a significant increase over the baseline period, where Internal Medicine had a medical record availability of 89%. General Surgery also had an increase in medical record availability during the post-implementation period. Primary Care record availability rose slightly during the same period. Orthopedics experienced a drop in medical record availability during the post-implementation period.

## 3. Patient and Staff Opinions

### a. Patients

Patients were asked whether their medical records were available for their clinic visit and where the records were located (at the clinic when they arrived, picked up at Medical Records, or brought from home). Patients were also asked about their satisfaction with the availability of medical records and were asked to comment about record availability. Results were obtained from the post-

TABLE 13

MEDICAL RECORD AVAILABILITY FOR APPOINTED PATIENTS IN STUDY CLINICS,  
TRIPAS EVALUATION, USAF MEDICAL CENTER, KEESLER AFB

<u>Clinic</u>	<u>Patients Seen</u>			
	<u>Total Number</u>		<u>Number (and Percent)</u>	
	<u>Base</u>	<u>Post</u>	<u>with Medical Records</u>	
			<u>Baseline</u>	<u>Post-impl.</u>
Booked by Clinic:				
Orthopedics	314	83	274 (87)	67 (81)
General Surgery	310	107	247 (80)	93 (87)
Booked by CAS:				
Internal Medicine	328	92	292 (89)	88 (96)
Primary Care	343	105	289 (84)	89 (85)
Total for all respondents	1,295	387	1,102 (85)	337 (87)

KEY: Base = baseline (manual system) study.

Post = post-implementation (automated system) study.

implementation Outpatient Questionnaire, which showed an 87% medical record availability. The table below summarizes the results from the Outpatient Questionnaire as to medical record and x-ray availability for both periods:

	<u>Baseline</u>	<u>Post-impl.</u>	<u>Change</u>
Medical Record Available	85%	87%	+2 percentage points
X-Ray Available	63%	68%	+5 percentage points

b. Providers

Medical care providers were asked to rate their satisfaction with the availability of medical records at the time of their patients' appointments. Their satisfaction rating showed an increase from 69% in the baseline period to 72% in the post-implementation period.

c. Support Staff

Interviews with Medical Records staff, although they did not provide quantifiable data, indicated that the automated pull list, whose hierarchy of numbers corresponded with the sequence of record filming, was far superior to the manual chits and that the automated charge-out cards improved efficiency.

4. Conclusions

The two measures of medical record availability, the Waiting Time Record and the Outpatient Questionnaire, were remarkably consistent in both the baseline and post-implementation periods. Both showed an 85% availability rate in the baseline period, and both were about 87% during the automated system evaluation. This represents little change for the four clinics taken as a whole.

There were definite changes, however, in the individual rates. The Orthopedics Clinic experienced a decrease in availability; the rate in Primary Care stayed roughly the same, while Surgery and Internal Medicine experienced increases. The post-implementation Internal Medicine availability rate is the only one that exceeds or

meets the standard level of performance (91%) established by provider estimates.

#### D. RECEIVING CARE AT THE APPOINTED TIME

##### 1. Description of the Process

At Keesler, almost all outpatient appointments were scheduled for a specific time slot. Most patients arrived in the clinic several minutes before their appointment time. After presenting themselves to the receptionist, they waited to be called by the care provider or received some preliminary tests or procedures from allied health care personnel. After receiving these tests, they again waited for the health care provider. Patients without scheduled appointments (walk-ins) were processed in a similar fashion.

##### 2. Clinic Workload

The number of cancellations and no-show, walk-in, and appointed patients were monitored for 10 days in the four sample clinics. Seventy-seven percent of patients seen during the baseline period had scheduled appointments; this figure dropped after implementation to 69%. In the baseline period, 6.0% did not show up and did not cancel their appointments. This no-show rate decreased very slightly after automation to 5.8% -- not a statistically significant decrease.

	<u>Baseline</u>	<u>Post-Impl.</u>
No show rate:		
• Primary Care	5%	4%
• General Survey	3%	11%
• Orthopedics	12%	8%
• Internal Medicine	6%	8%
• KMC 4 clinics average	6%	5.8%

##### 3. Patient Waiting Time

Patient waiting times were measured for a total of 464 patients. Seventy-three percent of these patients had appointments while 27% were walk-ins. The table below illustrates the breakdown of appointed patients versus walk-in patients by clinic after implementation of the automated system:



<u>Clinic</u>	<u>% Appointed</u>	<u>% Walk-ins</u>
Primary Care	89	11
General Surgery	86	14
Orthopedics	70	30
Internal Medicine	46	54

Table 14 shows the frequency distribution by clinic for both study periods. Table 15 compares the average waiting times by clinic for both periods. As in the baseline period, waiting time was defined as follows: for appointed patients, the time of appointment to the time the patient was seen by the physician in his office; for walk-in patients, the time the patient arrived in the clinic to the time he was seen by the physician. For scheduled patients who were seen by the physician before their actual time of appointment, waiting time was counted as zero.

For all patients, the average waiting time in the four clinics decreased by an average of 3 minutes. For active-duty patients, the average waiting time decreased by an average of 4 minutes (from 28 minutes down to 24 minutes), with the biggest improvement occurring in Internal Medicine. Non-active-duty patient waiting time decreased by 1.24 minutes, from 30.75 minutes to 29.51 minutes.

The percentage of patients seen within 30 minutes of their arrival in the clinic also improved significantly after implementation for all clinics:

<u>Clinic</u>	<u>Baseline</u>	<u>Post-impl.</u>	<u>Change</u>
Orthopedics	39%	48%	+9%
General Surgery	71%	80%	+9%
Internal Medicine	60%	89%	+29%
Primary Care	72%	79%	+7%

Twelve patients (3% of the total sample and 4% of all appointed patients) were late for their appointments and were excluded from the analysis performed in Table 14.

TABLE 14

PATIENT WAITING TIMES IN STUDY CLINICS,  
TRIPAS EVALUATION, USAF MEDICAL CENTER, KEESLER AFB

Waiting Times	Number (and Percent) of Patients Seen <sup>a</sup>							
	Orthopedics		Gen'l Surgery		Int'l Medicine		Primary Care	
	Baseline	Post-impl.	Baseline	Post-impl.	Baseline	Post-impl.	Baseline	Post-impl.
No wait	26 (8)	13 (16)	60 (19)	27 (28)	44 (13)	11 (23)	43 (13)	13 (13)
1-15 minutes	39 (12)	11 (13)	94 (30)	21 (21)	93 (29)	16 (34)	117 (34)	32 (32)
16-30 minutes	51 (19)	16 (19)	67 (22)	30 (31)	59 (18)	15 (32)	86 (25)	34 (34)
30+ minutes	190 (60)	43 (52)	85 (28)	20 (20)	128 (39)	5 (11)	87 (25)	21 (21)
No information	6 (1)	0 (0)	2 (1)	0 (0)	3 (1)	0 (0)	9 (3)	0 (0)
Total	312 (100)	83 (100)	308 (100)	98 (100)	327 (100)	47 (100)	342 (100)	100 (100)

<sup>a</sup>Excluding 52 patients (in the baseline study) and 12 patients (post-implementation) who arrived late for their appointments.

TABLE 15

AVERAGE PATIENT WAITING TIMES BY CLINIC,  
TRIPAS EVALUATION, USAF MEDICAL CENTER, KFESLER AFB

<u>Clinic</u>	<u>Waiting Time (in minutes)</u>		
	<u>Baseline</u>	<u>Post-impl.</u>	<u>Change</u>
Orthopedics	50	47	-3
General Surgery	23	21	-2
Internal Medicine	22	11	-11
Primary Care	23	23	0
Overall Average	29.3	26.4	-2.9

In the post-implementation study, the number of walk-in patients seen in all four clinics totalled 124. Their average waiting time varied from a low of 18.6 minutes in General Surgery to a high of 85.7 minutes in Orthopedics. In general, the average waiting time for walk-in patients improved in the clinics except for Orthopedics. The average waiting times for walk-in patients in each of the four clinics in each period are as follows:

<u>Clinic</u>	<u>Baseline</u>	<u>Post-impl.</u>	<u>Change</u>
Orthopedics	64 min	86 min	+22 min
General Surgery	28 min	19 min	-9 min
Internal Medicine	63 min	55 min	-8 min
Primary Care	N.A.	38 min	N.A.

The percentage of walk-in patients seen within 30 minutes of their arrival in the clinic likewise improved with the exception of Orthopedics:

<u>Clinic</u>	<u>Baseline</u>	<u>Post-impl.</u>	<u>Change</u>
Orthopedics	25%	8%	-17%
General Surgery	72%	93%	+21%
Internal Medicine	36%	39%	+3%
Primary Care	N.A.	50%	N.A.

Data were collected on the number of incorrectly appointed patients at each of the 4 sample clinics. These were patients who said they had appointments, but were not on the daily appointment lists. These patients were usually treated as if they were walk-ins. The number of errors decreased from 201 in the baseline to 34 during the post-implementation period.

#### 4. Patient Opinions

Patients were asked to rate their satisfaction with clinic waiting time on the Outpatient Questionnaire. The percentage of respondents who were very or somewhat satisfied was nearly the same

both before and after implementation. Sixty-three percent were satisfied in the baseline period compared to 64% after implementation.

#### E. SYSTEM COSTS

##### 1. Costs

Three sizes of the TRIPAS System will support the large, medium, and small MTF. They differ in the capacity of the main memory of the CPU and its associated hardware to support MTF workload. Of the proposed initial procurement of 12 systems, four of the TRIPAS sites are considered large according to the definition, five are medium, and three are small. For purposes of distributing front-end nonrecurring costs and simplifying the analysis, it is assumed that the option to purchase all 12 TRIPAS Systems will be exercised concurrently and that the systems have an operating life of 8 years.

Table 16 shows nonrecurring costs for each site regardless of size. These costs reflect vendor prices as specified in the bid of the prime contractor, but they have been increased to cover costs associated with a contract modification to that original bid. As indicated, the nonrecurring costs (per site regardless of size) total \$171,550.

Annual recurring costs and nonrecurring costs for communications, lines, and modems differ for the three MTF sizes, as shown in Table 17. Assuming nonrecurring costs are annualized, the cost per year for TRIPAS ranges from \$106,612 for a small site to \$203,955 for a large MTF such as Keesler.

##### 2. Cost per Workload Unit

Two measures of workload were considered appropriate units to analyze the impact of TRIPAS on costs:

1. Annual outpatient encounters;
2. Total annual appointment and administrative transactions associated with these outpatient encounters.

Outpatient encounters are scheduled visits, walk-ins, or telephone consultations. In both the manual and automated systems, names of walk-ins and telephone consultation patients are added to daily clinic lists of appointed patients who keep their appointments. At the end

TABLE 16

NONRECURRING COSTS OF TRI-SERVICE PATIENT  
APPOINTMENT AND SCHEDULING SYSTEM

<u>Cost Element</u>	<u>Cost</u>
Software fee	\$ 7,500
Software license	76,250
Training	14,800
Documentation	3,000
Transportation/Installation	25,000
Systems Implementation	15,000
Medical Treatment Recording Card	25,000
Maintenance Outside Principal Period of Maintenance	<u>5,000</u>
Total	\$171,500

NOTE: These non-recurring costs are not size dependent.

TABLE 17

COSTS OF TRI-SERVICE PATIENT APPOINTMENT AND SCHEDULING SYSTEM  
FOR LARGE, MEDIUM, AND SMALL MEDICAL TREATMENT FACILITIES

<u>Cost Element</u>	<u>Annual Cost, by Size of MTF</u>		
	<u>Large</u>	<u>Medium</u>	<u>Small</u>
NONRECURRING <sup>a</sup>			
Non-size-dependent costs	\$ 21,444	\$ 21,444	\$ 21,444
Communications, lines, modems	20,625	14,875 <sup>b</sup>	9,125
Total nonrecurring costs	\$42,069	\$36,319	\$30,569
RECURRING			
Hardware:			
CPU	\$ 26,730	\$ 10,842	\$ 7,338
CRT	18,492	14,628	6,649
On-line storage	3,900	6,984	5,484
Off-line storage	--	1,620	1,620
Line printer	1,290	1,290	1,290
Character printer	5,520	1,932	1,932
Communications interface	5,586	3,918	2,586
Operator's console	318	318	318
Maintenance:			
Software	26,800	26,800	26,800
Hardware	55,742	29,810	19,026
Communications, lines, modems	14,508	10,463 <sup>b</sup>	-- <sup>c</sup>
Medical treatment card	3,000	3,000	3,000
Total recurring costs	\$161,886	\$111,605	\$ 76,043
TOTAL COST	\$203,955	\$147,924	\$106,612

<sup>a</sup> Annualized over 8-year life cycle.

<sup>b</sup> Estimated from large and small systems costs.

<sup>c</sup> Cost included in hardware maintenance.

of the day, these lists are used to count clinic workload. TRIPAS automatically counts workload and produces statistical reports for administrative review.

For every outpatient visit, there is more than one appointment/administrative transaction. These transactions include registration, appointment bookings, cancellations, and several other types of information inquiries: confirmation/verification, appointments that cannot be booked for a variety of reasons, and responses to other questions about provider schedules and availability of appointments.

An accurate estimate of outpatient encounters was obtained from Keesler and an approximation of the number of transactions discussed above was calculated. According to Keesler workload reports, the number of outpatient encounters, including dental, in FY 1982 was 438,600. The difficulty in determining the number of transactions lies in the fact that data on transactions are available only for CAS, which does not account for all appointment transactions. The procedure described below was used to develop an overall estimate of transactions on the basis of total outpatient encounters and CAS workload data.

According to pre- and post-implementation data, CAS at Keesler experienced an average annual workload of 218,979 calls, classified as follows:

Appointment booked through CAS (including registration and registration verification)	119,016
Cancellations through CAS	6,525
Information from CAS (including appointment not available)	93,438

This information yields a ratio of 1.84 transactions per CAS booked appointment  $(119,016 + 6,525 + 93,438/119,016)$ .

The total number of visits made by appointment, including those booked by the clinics, as well as by CAS, was determined by taking total outpatient visits and eliminating clinic walk-ins, visits to the emergency room and dispensary, and sick-call clinics. Estimates of



these were obtained from workload data for a previous evaluation which determined that 39.2% of outpatient visits were for these types of visits. Using the converse of these percentages, total appointed visits came to 266,669 ( $438,600 \times 60.8\%$ ). Using the 1.84 ratio, these visits accounted for 490,671 transactions. The number of clinic walk-ins and visits to ER/AMIC (Emergency Room/Acute Minor Injury Clinic) is 438,600 less 266,669, or 171,931. Each of these visits represents a transaction, because each requires registration verification and logging for workload reporting. Thus, the total annual number of transactions is estimated to be 490,671 plus 171,931, or 662,602.

Dividing these annual workload units into the annual costs of using a large-sized TRIPAS system (\$203,955) yields a cost per outpatient visit of 46.5 cents and cost per transaction of 30.8 cents. For manual operation of the appointment and scheduling system, the cost per CAS transaction was calculated to be 43 cents. Therefore, before deducting any savings attributable to TRIPAS, the raw cost of operating the TRIPAS System approximately doubles the cost of appointment operations, to 74 cents per transaction.

Further analysis of costs and potential offsetting cost savings are assessed in a separate document on economic analysis.

#### IV. GOALS AND OBJECTIVES

In order to evaluate the TRIPAS System, the performance of TRIPAS at Keesler was compared to the system goals and objectives. A summary of this comparison is contained in Exhibit A. Three factors should be considered in assessing TRIPAS performance at Keesler. First, the data available in the evaluation are subject to two constraints. One is that baseline and post-implementation data were collected at different times of the year; the baseline data were collected in October and the post-implementation data in May. In general, outpatient appointment activities declined during the summer months and, by the end of May, it is likely that that dropoff would already have started. In fact, there was a lower level of appointing activity occurring at the time of the post-implementation study.

The second constraint was that the data in the post-implementation study were collected late in the month, whereas the baseline data were collected throughout the month of October. Appointment activities tend to cluster at the beginning of the month because most clinics make their schedules available at that time. These two factors probably contributed to a decline in appointing activities and a decline in patients presenting for appointments in the post-implementation study.

Also, the TRIPAS System had been operational for only 3 months at the time of the post-implementation data collection; therefore, although its immediate benefits could be assessed, some long-term benefits that depend on changing attitudes or management practices will probably appear only later in the system's lifecycle. There are also some benefits that accrue in accordance with user experience with the system. These also may not have been fully realized. In some ways, Keesler's appointment system may be unique in that, in areas where the performance was already high, TRIPAS may not have had as large an impact at Keesler as it would at a more typical facility. All these factors will be discussed relative to each goal and objective.

# EXHIBIT A

## COMPARISON OF TRIPAS PERFORMANCE TO SYSTEM GOALS AND OBJECTIVES

<u>Goal</u>	<u>Status at Implementation</u>	<u>Projected Change</u>
Reduced time to make a patient appointment	Realized in CAS	Realize throughout
Reduced clinic waiting time	Realized	Improve further with improved provider access
Reduced trips to receive care in multiple clinics on same day	Realized	Improve with improved provider access, knowledge of system capabilities
Reduced appointment clerical work	Realized	No change
Increased utilization by better matching patients, providers, facilities	Realized	Improve further with management intervention
Reduced "no-shows"	Not realized	Improve with management intervention
Reduced appointment transcription and processing errors	Realized	Improve further with database maintenance
Improved interfacility communication	Realized	Greater impact at other sites
Enhanced decision making	Not fully realized	Improve with expanded database, management intervention
Establishment of a data bank	Not fully realized	Improve with system use

1. Reduced time to make a patient appointment. The evaluation data showed a decline in the time to book a patient appointment at Keesler. The time required for other appointment activities declined even more. In the two clinics where patient appointment activities were observed, in one case the time to book appointments increased, and in another, it decreased. The evaluation results, combined with the results of the implementation monitoring activities, indicate that the time required to use the system to perform appointment activities is affected by the amount of training personnel have had on the system and their experience with it. Therefore, we expect that in future, the TRIPAS System will reduce the time to make patient appointments throughout the facility.

2. Reduced clinic waiting time. The waiting time measured in the post-implementation study at Keesler was reduced from that of the baseline study. It is difficult to tie this directly to the implementation of the TRIPAS System, however. Reduced clinic waiting time will come as a result of increased availability of providers through better scheduling and a reduction in walk-in patients. Therefore, it is likely that there will be a reduction in clinic waiting time as a result of future TRIPAS installations.

3. Reduced trips to receive care in multiple clinics. The data from the evaluation studies at Keesler indicate that there was a 2.9% increase in the number of patients who received more than one clinic appointment on the same day. The ability to receive care in multiple clinics is dependent on two factors: (1) provider availability, and (2) access to appointments for more than one provider. It also requires that patients are educated about the capabilities of the TRIPAS System and therefore the feasibility of scheduling multiple appointments. Therefore it is anticipated that in the future there will be even more multiple, same-day appointments scheduled through the TRIPAS System.

4. Reduced appointment clerical work. The clerical work associated with the appointing process has been reduced by the TRIPAS System. TRIPAS has automated the workload data collection and

automated the provider scheduling process. It is anticipated that the same benefits would accrue to future sites but that no further improvement will be realized at Keesler.

5. Increased utilization by better matching patients, providers, facilities. Data from the post-implementation study show an increase in provider productivity. The TRIPAS System, through improved scheduling and scheduling of more patients, does appear to enhance the utilization of providers. It is expected that through the management information that is gathered on the system, provider scheduling can be optimized; therefore, it is anticipated that utilization may further improve in the future.

6. Reduced "no-shows." There was not a significant decline in the no-show rate at Keesler after TRIPAS installation. However, the no-show rate at Keesler was very low in both studies. There also have not been any attempts to use the system to identify chronic offenders or chronic no-show patients and deal with these patients through patient education. Therefore it might be possible to decrease no-shows even at a facility like Keesler through management intervention and through the data management capabilities of the system.

7. Reduced appointment transcription and processing errors. The appointment transcription and processing errors have been reduced through the TRIPAS System. The benefit is mainly due to maintaining the registration data base and through eliminating many of the transcription steps. The key data elements are those maintained within the registration data base. Therefore it is likely that errors will be reduced further as that data base is improved and maintained.

8. Improved interfacility communication. There are two areas where the TRIPAS System has improved interfacility communication. One is that all clinics, even those that schedule through CAS, can obtain information on available appointment slots and therefore they can schedule more patients rather than have them walk in. The system has also improved communication between CAS and the clinics and Medical Records. Although at Keesler this did not result in an increase in the number of patients that were seen with medical records, the

percentage of patients seen with medical records at their appointments at Keesler was very high in both baseline and post-implementation studies. In other sites where there were problems with the medical records reaching the clinics at the appointed time, this system feature will probably be more of a benefit.

9. Enhanced decision making. The system at Keesler had been in operation for only 3 months and therefore there had not been time for an evaluation of the system's capability to enhance decision making to be conducted. It is anticipated that the data base will be used in making decisions about clinic management.

10. Establishment of a data bank. This goal again was not fully realized because of the fact that only 3 months' data were available at the time of the study. It is anticipated that this data bank will be of great benefit when 6 months to a year's worth of data have been accumulated.

## V. REFERENCES

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3. Report of the Interim Evaluation of the Patient Appointment and Scheduling System of Brooke Army Medical Center and Ehrling Bergquist USAF Regional Hospital, October 1982.
4. TRIMIS Medical Review Group. Initial Project Objectives and Evaluation Criteria. TRIMIS Program Office, Bethesda, Maryland, April 1978.
5. Post-Implementation Evaluation Plan for the Patient Appointment and Scheduling System at USAF Medical Center, Keesler Air Force Base, September 26, 1983.

APPENDIX A  
POST-IMPLEMENTATION QUESTIONNAIRES



OUTPATIENT QUESTIONNAIRE

Orthopedics  
General Surgery  
Int'l Medicine  
Clinic Primary Care  
Date May 1983  
Time Postimplementation  
(Composite Results)

We ask you to take a few minutes to answer some questions about our patient care and the appointment scheduling system here. Information from this questionnaire will help us provide the best possible medical care. All responses will be held in strictest confidence.

1. Is this your first visit to this clinic? (check one)

21.9% 1. 111 yes  
78.1% 2. 397 no  
3. 0 can't remember

2. How would you describe your need for this appointment? (check one)

16.9% 1. 84 emergency (needed to be seen on same day)  
41.0% 2. 204 semi-urgent (needed to be seen within a few days)  
42.1% 3. 210 routine (next available appointment, within 14 days)

3. Please check the appropriate category for your appointment. (check one)

77.0% 1. 391 scheduled appointment  
16.1% 2. 82 unscheduled; but someone referred me (check one)

49.3% 1. 37 Emergency Room  
20.0% 2. 15 another clinic  
30.7% 3. 23 other, please specify: \_\_\_\_\_

2.8% 3. 14 unscheduled; I tried to make an appointment myself, but could not get one

4.1% 4. 21 unscheduled; did not try to make an appointment; was not referred

WALK-IN PATIENTS SKIP TO QUESTION 9.

FOR PATIENTS WITH SCHEDULED APPOINTMENTS:

4. How long ago did you schedule your appointment?

4.5% 1. 17 today  
27.0% 2. 102 1-2 days  
15.1% 3. 57 3-7 days  
18.8% 4. 71 8-14 days  
27.2% 5. 103 15-30 days  
7.4% 6. 28 over 30 days

5. Would you have liked an appointment sooner than you were able to schedule one?

30.1% 1. 113 yes  
69.9% 2. 263 no How much sooner? \_\_\_\_\_

6. How did you schedule this appointment? (check one)

40.6% 1. 151 through central appointment scheduling (CAS)  
59.4% 2. 221 through the clinic

7. By what means did you schedule it? (check one)

- 8.9% 1. 30 by CAS phone-on post (in clinic areas)  
57.2% 2. 192 by another phone  
0.6% 3. 2 by mail  
33.0% 4. 111 in person - at clinic desk  
0.3% 5. 1 other, please specify \_\_\_\_\_

8. If you made the appointment by telephone: How many attempts to call did you make before you got an appointment?

- 38.4% 1. 87 1 attempt (got through on first attempt)  
19.4% 2. 44 2 attempts  
18.9% 3. 43 3 attempts  
19.8% 4. 45 more than 3 attempts, specify how many \_\_\_\_\_  
3.5% 5. 8 can't remember

#### ALL PATIENTS

9. Do you have an appointment scheduled in another clinic for today?

- 9.2% 1. 46 yes  
90.8% 2. 453 no

Would you have liked to schedule another appointment for today if this were possible?

- 25.7% 1. 115 yes  
74.3% 2. 333 no

10. Were your records available for this visit to the clinic?

- Medical Records: 1. 430 yes 87.8%  
2. 60 no 12.2%

- X-Rays: 1. 106 yes 68.4%  
2. 49 no 31.6%

11. If either your medical records or your X-rays or both were available, please tell us where they were.

- Medical Records: 1. 226 They were at the clinic when I arrived 56.9%  
2. 118 I picked them up on my way here 29.7%  
3. 53 I brought them with me from home 13.4%

- X-Rays: 1. 52 They were at the clinic when I arrived 57.8%  
2. 38 I picked them up on my way here 42.2%

12. Are you taking time off from work to come to this appointment?

- 47.2% 1. 235 yes  
52.8% 2. 263 no

13. The following statements describe various aspects of the outpatient clinics at KMC. Please indicate how satisfied you are with each aspect by putting a check in the column that best describes your opinion.

Statements

	Net Positive (%)	Very satisfied 1. _____	Somewhat satisfied 2. _____	Undecided 3. _____	Not very satisfied 4. _____	Not at all satisfied 5. _____
Ease of booking appointments.....	71.2	191	128	41	53	35
Availability of appointments at time desired.....	68.9	155	153	35	76	28
The telephone system for making appointments....	61.4	147	123	60	61	49
Special instructions for preparing for appointment.....	75.7	197	102	73	15	8
Finding clinic location.....	89.6	302	105	16	20	11
Parking.....	59.2	131	134	28	89	66
Waiting time in clinic.....	63.7	131	138	50	68	35
Availability of medical records.....	86.6	289	91	22	18	19
Attitude and helpfulness of appointment personnel.....	87.7	308	97	25	17	15
Appointment scheduling system in general.....	72.3	168	159	42	53	30
Overall experience with care system.....	82.7	240	138	37	31	11

15. Do you have any additional comments or suggestions?

16. Please indicate your status. (check one)

32.6% 1. 159 Active duty military  
(military rank \_\_\_\_\_)  
23.8% 2. 116 Retired military  
16.2% 3. 79 Dependent of active duty military  
26.6% 4. 130 Dependent of retired/deceased  
0.2% 5. 1 Civilian personnel  
0.6% 6. 3 Other (please specify \_\_\_\_\_)

Thank you for taking the time to fill out this questionnaire.

May 1983, Keesler AFB  
Postimplementation  
Composite Results

### HEALTH CARE PROVIDER QUESTIONNAIRE

1. Please write the month, day, and year of your birth. It will be used as an anonymous way to match your responses to surveys done before and after installation of the new patient appointment and scheduling system.

                      
month    day    year

(If you completed a questionnaire regarding the manual appointment and scheduling system, skip to question 6.)

2. What is the name of the outpatient clinic where you usually work?

Orthopedics      General Surgery      Internal Medicine      Primary Care

3. Do you work at other outpatient clinics on base?      1  yes          2)no

If yes, specify which one(s)?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

4. What functions, if any, do you perform related to appointment scheduling?  
Check all that apply.

  25   1) refer patients for appointments

   7   2) participate in establishing monthly appointment schedules

   5   3) make appointments for patients I am referring to other clinics

   3   4) other (specify) \_\_\_\_\_

   2   5) do not perform any functions related to patient appointment scheduling

5. In your view, how important is the patient appointment and scheduling system to the quality of care at KMC? Check one.

74.1% 20 1) very important

22.2% 6 2) important

       3) undecided, no opinion

3.7% 1 4) not very important

       5) not at all important

6. We would now like your opinion about the present appointment and scheduling system. For each of the following statements, please tell us how well the current system generally performs.

a) Percent of care providers who express satisfaction with the overall quality of appointment and scheduling service.

1) 56 %

b) Percent of scheduled patients who keep their appointments

2) 87 %

c) Percent of scheduled patients who have X-rays available for their appointment.

3) 41 %

d) Percent of scheduled patients who are appropriately scheduled at the outpatient clinic where you usually work. (This statement refers exclusively to clinical "appropriateness").

4) 84 %

e) Percent of scheduled patients who have a medical record available for their appointment.

5) 82 %

7. The following statements describe various aspects of the scheduling system. Please indicate how satisfied you are with each aspect of the current system by placing an "X" under the column that best describes your opinion.

Net Positive (%)		Very Satisfied	Somewhat Satisfied	Undecided/ No Opinion	Not Very Satisfied	Not at all Satisfied
60	a) Patient's ease of booking appointments.	1. <u>6</u>	2. <u>15</u>	3. <u>1</u>	4. <u>8</u>	5. <u>5</u>
55	b) Patient's ability to book appointments at time desired.	1. <u>9</u>	2. <u>10</u>	3. <u>5</u>	4. <u>6</u>	5. <u>5</u>
80	c) Waiting time after patient arrives.	1. <u>13</u>	2. <u>15</u>	3. <u>3</u>	4. <u>4</u>	5. <u>0</u>
72	d) Availability of medical records at time of appointment at your clinic.	1. <u>8</u>	2. <u>17</u>	3. <u>0</u>	4. <u>8</u>	5. <u>2</u>
40	e) Telephone system for making appointments.	1. <u>3</u>	2. <u>11</u>	3. <u>5</u>	4. <u>9</u>	5. <u>7</u>
35	f) Availability of x-rays at time of appointment at your clinic.	1. <u>0</u>	2. <u>12</u>	3. <u>9</u>	4. <u>6</u>	5. <u>6</u>
76	g) Accuracy of assigning patients to appropriate clinic.	1. <u>9</u>	2. <u>17</u>	3. <u>2</u>	4. <u>5</u>	5. <u>1</u>
53	h) Ability of appointment and scheduling to accommodate:					
	Flexible schedules	1. <u>4</u>	2. <u>14</u>	3. <u>3</u>	4. <u>7</u>	5. <u>6</u>
69	Cancellations	1. <u>8</u>	2. <u>15</u>	3. <u>7</u>	4. <u>0</u>	5. <u>3</u>
56	Changes in provider schedules	1. <u>5</u>	2. <u>14</u>	3. <u>3</u>	4. <u>5</u>	5. <u>7</u>
36	Same day multiple clinic visits	1. <u>4</u>	2. <u>8</u>	3. <u>12</u>	4. <u>6</u>	5. <u>4</u>

Net  
Positive  
(%)

Special instructions that  
must be given to patients  
prior to their visits.

54 1. 6 2. 13 3. 10 4. 5 5. 1

Patients requiring special  
processing and care.

51 1. 6 2. 12 3. 8 4. 4 5. 5

Patients requiring  
immediate appoint-  
ments.

31 1. 4 2. 7 3. 5 4. 11 5. 8

1) Overall quality  
of appointment and  
scheduling service.

63 1. 8 2. 14 3. 3 4. 6 5. 4

Thank you for your cooperation. Please return this questionnaire to the  
data collector.

### Postimplementation Composite Results

- Month/Day/Year**

1. 7 CAS      Orthopedics - 9  
Primary Care - 11  
General Surgery - 4

2. 27 Outpatient Clinic: Internal Medicine - 3

Name of Clinic

- 23 1) refer patients for appointments
- 17 2) participate in establishing monthly appointment schedule
- 30 3) make patient appointments (by telephone or at the clinic)
- 29 4) verify (confirm) appointments
- 29 5) cancel appointments
- 6) do not perform any functions related to patient appointment scheduling
- 5 7) other (specify)

- 24 1) very important
- 6 2) somewhat important
- 1 3) undecided, no opinion
- 1 4) not very important
- 5) not at all important



5. We would also like your opinions about how the present appointment and scheduling system performs. For each of the following measures of performance, please indicate how well you think the current system has done.

PERFORMANCE MEASURE

EVALUATION OF THE CURRENT  
APPOINTMENTS & SCHEDULING SYSTEM

- a) Percent of scheduling and support staff expressing satisfaction with the overall quality of appointment and scheduling service. (29 respondents) 76.7 % (2225.5)
- b) Percent of the scheduled patients who keep their appointments (28 respondents) 91 % (2547)

6. Please indicate how satisfied you are with each of the following aspects of the current appointment and scheduling system by placing an "X" under the column that best describes your opinion.

Net Positive (%)		Very Satisfied	Somewhat Satisfied	Undecided/ No opinion	Not Very Satisfied	Not at all Satisfied
82	a) Patients ease of booking appointments	1. <u>12</u>	2. <u>16</u>	3. <u>1</u>	4. <u>5</u>	5. <u>        </u>
85	b) Patient's ability to book appointments at time desired.	1. <u>9</u>	2. <u>20</u>	3. <u>2</u>	4. <u>2</u>	5. <u>        </u>
74	c) Telephone system for making appointments	1. <u>8</u>	2. <u>17</u>	3. <u>2</u>	4. <u>5</u>	5. <u>2</u>
	d) Ability of appointment and scheduling system to accommodate:					
94	1. Cancellations	1. <u>26</u>	2. <u>6</u>	3. <u>        </u>	4. <u>1</u>	5. <u>1</u>
76	2. Changes in provider schedules	1. <u>14</u>	2. <u>11</u>	3. <u>3</u>	4. <u>3</u>	5. <u>2</u>
64	3. Same day multiple clinic visits	1. <u>11</u>	2. <u>10</u>	3. <u>12</u>	4. <u>        </u>	5. <u>        </u>
74	4. Special instructions that must be given to patients prior to their visits.	1. <u>14</u>	2. <u>11</u>	3. <u>9</u>	4. <u>        </u>	5. <u>        </u>

Net Positive (%)		Very Satisfied	Somewhat Satisfied	Undecided/ No Opinion	Not Very Satisfied	Not at all Satisfied
82	5. Patients requiring immediate appointments	1. <u>12</u>	2. <u>16</u>	3. <u>2</u>	4. <u>4</u>	5. <u>0</u>
67	6. Patients requiring special processing and care.	1. <u>10</u>	2. <u>12</u>	3. <u>10</u>	4. <u>1</u>	5. <u>      </u>
69	7. Appointments which vary in length (e.g., 15 vs. 30 vs. 45 minutes).	1. <u>12</u>	2. <u>10</u>	3. <u>8</u>	4. <u>2</u>	5. <u>      </u>
35	8. Ability of patients to obtain appointments by mail.	1. <u>7</u>	2. <u>4</u>	3. <u>18</u>	4. <u>1</u>	5. <u>1</u>
88	e) Overall quality of appointment and scheduling service.	1. <u>15</u>	2. <u>15</u>	3. <u>1</u>	4. <u>3</u>	5. <u>      </u>
	f) Relative ease for you to accommodate:					
91	1. Appointing patients	1. <u>18</u>	2. <u>13</u>	3. <u>1</u>	4. <u>2</u>	5. <u>      </u>
97	2. Cancelling appointments	1. <u>22</u>	2. <u>11</u>	3. <u>      </u>	4. <u>      </u>	5. <u>1</u>
88	3. Rescheduling appointments	1. <u>19</u>	2. <u>11</u>	3. <u>1</u>	4. <u>2</u>	5. <u>1</u>
76	4. Dispensing information to patients	1. <u>17</u>	2. <u>9</u>	3. <u>6</u>	4. <u>2</u>	5. <u>      </u>

APPENDIX B

EVALUATION OF THE DENTAL CLINIC,  
USAF MEDICAL CENTER, KEESLER AFB

The Dental Clinic was evaluated only for patient satisfaction and provider opinions. Approximately 100 patients and 25 dentists were surveyed over a 2-day period during both the baseline and post-implementation evaluations.

Patient satisfaction levels in the baseline period were remarkably high compared to those in the four sample medical clinics in the hospital. Eight of the eleven service aspects that patients were questioned on received satisfaction ratings of above 90%. Opinions ranged from a low of 83% satisfied for the telephone system to a 99% satisfaction level regarding patients' ease of booking appointments. The figures from the post-implementation evaluation were higher in some cases and lower in others, but none of the changes were very large. Table B-1 lists percentages for several of the service aspects measured. The greatest change was a decrease in satisfaction with patients' ease of booking appointments, down to 93% satisfied. Even so, satisfaction with the overall experience with the care system increased from 92% to 94%.

Dentists were given the same questionnaire as the hospital providers. Their satisfaction levels were down in the post-implementation period in almost every area (see Table B-2). The only survey area that showed an increase in dental provider satisfaction was the telephone system for making appointments. Provider satisfaction decreased from 88% to 72% in regard to patients' ease of booking appointments, and satisfaction with the ability of the system to accommodate changes in provider schedules went from 77% (baseline) to 61% (post-implementation). Satisfaction with the overall quality of the appointment and scheduling service decreased from 88% to 76%. Provider goal levels established in the baseline period for the level of provider satisfaction with the overall appointment system were 77% (standard) and 90% (highest level expected). Thus, the satisfaction ratings reflected a change from excellent to average as far as dental provider opinions are concerned.

TABLE B-1

COMPARISON OF BASELINE AND POST-IMPLEMENTATION SATISFACTION LEVELS  
FOR OUTPATIENTS AT DENTAL CLINIC, USAF MEDICAL CENTER, KEESLER AFB

<u>Impact Area</u>	<u>% of Respondents Expressing Satisfaction</u>		<u>% Change</u>
	<u>Baseline</u>	<u>Post-impl.</u>	
Ease of booking appointments	99	93	-6
Availability of appointment at time desired	93	93	0
Telephone system for making appointments	83	81	-2
Appointment and scheduling system in general	97	95	-2
Overall experience with care system	92	94	+2

TABLE B-2

COMPARISON OF BASELINE AND POST-IMPLEMENTATION SATISFACTION LEVELS  
FOR HEALTH CARE PROVIDERS AT DENTAL CLINIC, USAF MEDICAL CENTER,  
KEESLER AFB

<u>Impact Area</u>	<u>% of Respondents Expressing Satisfaction</u>		<u>% Change</u>
	<u>Baseline</u>	<u>Post-impl.</u>	
Patients' ease of booking appointments	88	72	-16
Patients' ability to book appointments at time desired	92	83	-9
Waiting time after patient arrives	96	84	-12
Telephone system for making appointments	46	60	+14
Accuracy of assigning patients to appropriate clinic	92	92	0
Ability of appointment and scheduling system to accommodate:			
Changes in provider schedules	77	61	-16
Patients requiring immediate appointments	77	63	-14
Overall quality of appointment and scheduling service	88	76	-12

APPENDIX C  
IMPLEMENTATION MONITORING CRITERIA AND RESULTS

TABLE C-1

## TRIPAS SYSTEM PERFORMANCE CRITERIA

<u>A. System Operation/Structure</u>	<u>Goal</u>
1. TRIPAS uptime	95% uptime for 2 months
2. Clerks & technicians trained	95% of personnel trained
3. Terminals in use	100% of terminals in use
4. Printers in use	100% of printers in use
5. Patient population registered	85% of patients registered
6. Provider schedules loaded	100% of schedules loaded
7. Pre-existing appointments loaded	100% of appointments loaded
<u>B. System Use/Process</u>	
8. Clerks & technicians experienced in TRIPAS use	95% of personnel unassisted use for one month
9. Users meeting operational standards for quality	95% perform a standard test
10. Users meeting operational standards for time	95% book appt. in 150 sec. or less
11. Use of software modules, options, and functions	100% of modules used
12. Manual tasks supported by software modules, options, & functions	0% of functions manual
<u>C. System Benefits/Outcome</u>	
13. Clerk & technician productivity I (seconds/transaction)	75% of personnel take 100 sec or less per transaction
14. Clerk & technician productivity II (transactions/hour)	75% of personnel perform 22 transactions per hour
15. Average waiting time for phone to be answered (peak time)	50% of calls at or less than 40 seconds
16. Clinic no-shows	3 of 4 clinics at 6% or less
17. Satisfaction with TRIPAS system performance (staff)	95% express satisfaction
18. Satisfaction with appointment & scheduling system (patients)	80% express satisfaction
19. Satisfaction w/TRIPAS reports & products (supervisors & NCOICs)	95% express satisfaction



TABLE C-2  
SUMMARY OF RESULTS

		<u>Meets Goal</u>	
		<u>Yes</u>	<u>No</u>
A.	System Operation/Structure		
1.	TRIPAS uptime	X	
2.	Clerks and technicians trained		X
3.	Terminals in use	X	
4.	Printers in use	X	
5.	Patient population registered		X
6.	Provider scheduled loaded	X	
7.	Pre-existing appointments loaded	X	
B.	System Use/Process		
8.	Clerks & technicians experienced in TRIPAS system use		X
9.	Users meeting operational standards (quality)	X	
10.	Users meeting operational standards (time)	X	
11.	Use of software modules, options, and functions		X
12.	Manual tasks supported by software modules, options and functions	X	
C.	System Benefits/Outcome		
13.	Clerk & technician productivity (I)	X	
14.	Clerk & technician productivity (II)		X
15.	Average waiting time to have telephone answered (peak time)	X	
16.	No shows	X	
17.	Satisfaction with TRIPAS system performance (staff)	X	
18.	Satisfaction with appointment and scheduling system (patients)	X	
19.	Satisfaction with TRIPAS reports and products (supervisors & NCOICs)		X

APPENDIX D

PROVIDER PRODUCTIVITY DATA AND STATISTICAL ANALYSIS

The variations in hours per visit appear to be due to the introduction of the patient appointment scheduling (PAS) system, rather than chance. The differences appear to be statistically significant at the 1% level after performing a two-tailed t-test. The overall mean change in visits per physician hour for all data is .31 visits per hour more following TRIPAS. The overall mean change in physician time per visit is .078 hours per visit less following TRIPAS.

TABLE D-1

PROVIDER PRODUCTIVITY DATA FROM KEESETER AFB  
BEFORE AND AFTER TRIPAS FOR 23 CLINICS

	Oct. '82			Oct. '83			'82-'83
	Visits	Hours	Visits/ Hour	Visits	Hours	Visits/ Hour	% Change
<u>Medical</u>							
1. Gen'l Practice	3227	802	4.02	2394	592	4.04	+ 0.5%
2. Allergy	753	497.5	1.51	887	384.75	2.31	+53.0%
3. Cardiology	257	347	0.74	545	245	2.22	+200.0%
4. Dermatology	612	205	2.98	925	349	2.68	-10.1%
5. Gastroenterology	334	252	1.33	638	202.75	3.15	+136.8%
6. Hematology	238	115.5	2.06	255	78	3.27	+58.7%
7. Medicine	1829	1124	1.63	2080	725.75	2.87	+76.1%
8. Neurology	188	268.75	0.70	290	345	0.84	+20.0%
9. Pediatrics	2420	1357.25	1.78	3426	2514.25	1.36	-23.6%
10. Psychiatry	1252	541.5	2.31	1720	624.5	2.76	+19.5%
11. Pulmonary	149	236.25	0.63	330	157	2.10	+233.3%
12. Other*	590	669.5	0.88	553	292	1.89	+114.8%
<u>Surgery</u>							
13. Gynecology	1032	373	2.77	1313	291	4.51	+62.8%
14. Neurosurgery	62	395	0.32	107	294	0.36	+12.5%
15. Obstetrics	742	389	1.91	823	262	3.14	+64.4%
16. Ophthalmology	704	226	3.11	565	246	2.30	-26.0%
17. Orthopedics	1100	566	1.94	836	422	1.98	+2.1%
18. Otolaryngology	433	203	2.13	480	146	3.29	+54.5%
19. Plastic Surgery	130	67	1.94	74	45	1.64	-15.5%
20. Thoracic	79	392	0.20	86	362	0.24	+20.0%
21. Urology	354	272	1.30	428	234	1.83	+40.8%
22. Gen'l & Other Surgery	2271	900.25	2.52	2059	650	3.17	+25.8%
23. Flight Medicine	650	523.75	1.24	546	462.25	1.18	-4.8%
TOTAL	19406	10523.25	1.844	21366	9924.25	2.15	

\*Includes Diabetes, Endocrinology, Hypertension, Nephrology, Nutrition, Oncology, Rheumatology, and Medical Genetics Clinics.

TABLE D-2

STATISTICAL ANALYSIS (TWO-TAILED T-TEST) OF CHANGE  
IN PATIENT VISITS PER PHYSICIAN HOUR  
AS A RESULT OF TRIPAS AT KEESLER AFB

<u>Clinics</u>	<u>1982 Visits/hour</u>	<u>1983 Visits/hour</u>	<u>Change in Visits/hour</u>
1	4.02	4.04	.02
2	1.51	2.31	-.80
3	0.74	2.22	-1.48
4	2.98	2.68	+0.30
5	1.33	3.15	-1.82
6	2.06	3.27	-1.21
7	1.63	2.87	-1.24
8	0.70	0.84	-0.14
9	1.78	1.36	0.42
10	2.31	2.76	-0.45
11	0.63	2.10	-1.47
12	0.88	1.89	-1.01
13	2.77	4.51	-1.74
14	0.32	0.36	-0.04
15	1.91	3.14	-1.23
16	3.11	2.30	0.81
17	1.94	1.98	-0.04
18	2.13	3.29	-1.16
19	1.94	1.64	0.30
20	0.20	0.24	-0.04
21	1.3	1.83	-0.53
22	2.52	3.17	-0.65
23	1.24	1.18	0.06
Sum			-13.14
Mean			-0.57
Sum of squares			20.158
(Sum) <sup>2</sup> /n			7.507
Sum of sq abt mean <sub>2</sub>			12.651
S <sub>d</sub> <sup>2</sup>			0.575

$$t_{22} = \frac{-0.57 - 0}{\sqrt{0.575/22}} = -3.526*$$

\*Statistically significant at the .01 level.

END

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DTIC